PROGRAMME AND COURSE OUTCOMES (CBCS)

OF

DEPARTMENT OF MATHEMATICS

S. B. DEORAH COLLEGE

ULUBARI GUWAHATI-07

DEPARTMENT OF MATHEMATICS
B.Sc (Mathematics) General and Honours

Programme Specific Outcome	The completion of the Programme shall enable a student to: PO1. Communicate mathematics effectively by oral, written, computational and graphic means. PO2. Create mathematical ideas from basic axioms. PO3. Gauge the hypothesis, theories, techniques and proofs provisionally. PO4. Utilize mathematics to solve theoretical and applied problems by critical understanding, analysis and synthesis. PO5. Identify applications of mathematics in other disciplines and in the real world, leading to enhancement of career prospects in a plethora of fields. PO6. Appreciate the requirement of lifelong learning through continued education and research.

Course Outcomes of B.Sc (Mathematics) General and Honours			
Semester	**Course Category**	**Paper Code and Course Name**	**Outcomes**
1st	Honours	**MAT-HC-1016 Calculus**	This course will enable the students to: i) Learn first and second derivative tests for relative extremum and apply the knowledge in problems in business, economics and life sciences. ii) Sketch curves in a plane using its mathematical properties in different coordinate systems. 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.

	Honours	**MAT-HC-1026 Algebra**	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 congruences. iv) Recognize consistent and inconsistent systems of linear equations by the row eMATlon form of the augmented matrix. v) Learn about the solution sets of linear systems using matrix method and Cramer's rule.
	Generic/Regular	**MAT-HG/RC-1016** **Calculus**	The students who take this course will be able to: i) Understand continuity and differentiability in terms of limits. ii) Describe asymptotic behavior in terms of limits involving infinity. iii) Use derivatives to explore the behavior of a given function, locating and classifying its extrema, and graphing the function. iv) Understand the importance of mean value theorems.
2ⁿᵈ Sem	**Honours**	**MAT-HC-2016: Real Analysis**	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. iv) Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

	Honours	**MAT-HC-2026:** **Differential Equations**	i) Learn basics of differential equations and mathematical modeling. ii) Formulate differential equations for various mathematical models. iii) Solve first order non-linear differential equations and linear differential equations of higher order using various techniques. iv) Apply these techniques to solve and analyze various mathematical models.
	Generic/Regular	**MAT-HG-2016/MAT-RC-2016** **Algebra**	i) Learn how to solve the cubic and biquadratic equations, also learn about symmetric functions of the roots for cubic and biquadratic ii) Employ De Moivre's theorem in a number of applications to solve numerical problems. iii) Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix. Finding inverse of a matrix with the help of Cayley-Hamilton theorem iv) Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, ring etc. **v)** Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space**.**

3ʳᵈ Sem	**Honours**	**MAT-HC-3016: Theory of Real Functions**	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.
	Honours	**MAT-HC-3026: Group Theory - I**	The 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.
	Honours	**MAT-HC-3036: Analytical Geometry**	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.

	Generic/Regular	**MAT-HG-3016/MAT-RC-3016** **Differential Equations**	The course will enable the students to: i) Learn basics of differential equations and mathematical modelling. ii) Solve first order non-linear differential equations and linear differential equations of higher order using various techniques..
	Skill Enhancement Course	**MAT-SE-3024: Combinatorics and Graph Theory**	This course will enable the students to: i) Learn about the counting principles, permutations and combinations, Pigeonhole principle. ii) Understand the basics of graph theory and learn about social networks, Eulerian and Hamiltonian graphs, diagram tracing puzzles and Knight's tour problem.
4th	**Honours**	**MAT-HC-4016: Multivariate Calculus**	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. iii) Learn about inter-relationship amongst the line integral, double and triple integral formulations. iv) Familiarize with Green's, Stokes' and Gauss divergence theorems.
	Honours	**MAT-HC-4026: Numerical Methods**	The 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 and LU decomposition. iii) Interpolation techniques to compute the values for a tabulated function at points not in the table. iv) Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.
	Honours	**MAT-HC-4036: Ring Theory**	On completion of this course, the student will be able 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 homomorphism and isomorphism theorems of rings. iv) Learn about the polynomial rings over commutative rings, integral domains, Euclidean domains, and UFD.
	Generic/Regular	**MAT-HG-4016/ MAT-RC-4016: Real Analysis**	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 R 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. iv) Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

	Skill Enhancement Course	**MAT-SE-4024: LaTeX and HTML**	After studying this course the student will be able to: i) Create and typeset a LaTeX document. ii) Typeset a mathematical document using LaTex. iii) Learn about pictures and graphics in LaTex. iv) Create beamer presentations. v) Create web page using HTML.
5th	**Honours**	**MAT-HC-5016: Riemann Integration and Metric spaces**	The course will enable the students to: i) Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental theorems of integration. ii) Know about improper integrals including, beta and gamma functions. 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. iv) Analyse how a theory advances from a particular frame to a general frame. v) Appreciate the mathematical understanding of various geometrical concepts, viz. Balls or connected sets etc. in an abstract setting. 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. vii) Learn about the two important topological properties, namely connectedness and compactness of metric spaces.
			The course will enable the students to:

5th	**Honours**	**MAT-HC-5026: Linear Algebra**	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 well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result. iv) Compute inner products and determine orthogonality on vector spaces, including Gram−Schmidt orthogonalization to obtain orthonormal basis. v) Find the adjoint, normal, unitary and orthogonal operators.
	Honours **(Discipline Specific Elective (DSE))**	**MAT-HE-5016: Number Theory**	This course will enable the students to: i) Learn about some fascinating discoveries related to the properties of prime numbers, and some of the open problems in number theory, viz., Goldbach conjecture etc. ii) Know about number theoretic functions and modular arithmetic. iii) Solve linear, quadratic and system of linear congruence equations.

	Honours **(Discipline Specific Elective (DSE))**	**MAT-HE-5066: Programming in C**	After completion of this paper, student will be able to: i) Understand and apply the programming concepts of C which is important to mathematical investigation and problem solving. ii) Learn about structured data-types in C and learn about applications in factorization of an integer and understanding Cartesian geometry and Pythagorean triples. iii) Use of containers and templates in various applications in algebra. iv) Use mathematical libraries for computational objectives. v) Represent the outputs of programs visually in terms of well formatted text and plots.
	Generic/Regular **(Discipline Specific Elective (DSE))**	**MAT-RE-5016: Number Theory**	This course will enable the students to: i) Learn about some fascinating discoveries related to the properties of prime numbers, and some of the open problems in number theory, viz., Goldbach conjecture etc. ii) Know about number theoretic functions and modular arithmetic. iii) Solve linear, quadratic and system of linear congruence equations.
5th	**Regular (SEC)**	**MAT-SE-5014: Combinatorics and Graph Theory**	This course will enable the students to: i) Learn about the counting principles, permutations and combinations, Pigeonhole principle ii) Understand the basics of graph theory and learn about social networks, Eulerian and Hamiltonian graphs, diagram tracing puzzles and Knight's tour problem.
	Honours	**MAT-HC-6016: Complex Analysis**	Completion of the course will enable the students to: CO1. Learn the significance of differentiability of complex functions leading to the understanding of Cauchy−Riemann equations.

6th			CO2. Learn some elementary functions and can evaluate the contour integrals. CO3. Understand the role of Cauchy−Goursat theorem and the Cauchy integral formula. CO4. 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.
	Honours	**MAT-HC-6026: Partial Differential Equations**	The course will enable the students to: CO1. Formulate, classify and transform first order PDEs into canonical form. CO2. Learn about method of characteristics and separation of variables to solve first order PDE's. CO3. Classify and solve second order linear PDEs. CO4. Learn about Cauchy problem for second order PDE and homogeneous as well as nonhomogeneous wave equations. CO5. Apply the method of separation of variables for solving second order PDEs.
	Honours **(DSE)**	**MAT-HE-6016: Boolean Algebra and Automata Theory**	The course will enable the students to: i) Learn about the order isomorphism, Hasse diagrams, building new ordered set. ii) Learn about the algebraic structure lattices, properties of modular and distributive lattices. iii) Get ideas about the Boolean algebra, Switching circuits and applications of switching circuits. iv) Appreciate the theory of automata and its applications.

	Regular **(DSE)**	**MAT-RE-6026:** **Programming in C**	After completion of this paper, student will be able to: i) Understand and apply the programming concepts of C which is important to mathematical investigation and problem solving. ii) Learn about structured data-types in C and learn about applications in factorization of an integer and understanding Cartesian geometry and Pythagorean triples. iii) Use of containers and templates in various applications in algebra. iv) Use mathematical libraries for computational objectives. v) Represent the outputs of programs visually in terms of well formatted text and plots.
	Skill Enhancement Course (Regular)	**MAT-SE-6014:** **LaTeX and HTML**	After studying this course the student will be able to: i) Create and typeset a LaTeX document. ii) Typeset a mathematical document using LaTex. iii) Learn about pictures and graphics in LaTex. iv) Create beamer presentations. v) Create web page using HTML.