MANGALDAI COLLEGE, DARRANG, ASSAM

PROGRAMME OUTCOMES, PROGRAMME SPECIFIC OUTCOMES
&
COURSE OUTCOMES

DEPARTMENT OF MATHEMATICS

iii. BSc Mathematics

Programme Specific Outcomes

After the completion of the programme, a student will be able to:

1. Communicate mathematics effectively by oral, written, computational and graphic means.
2. Create mathematical ideas from basic axioms.
3. Gauge hypotheses, theories, techniques, and proofs provisionally.
4. Utilize mathematics to solve theoretical and applied problems through critical understanding, analysis, and synthesis.
5. Identify the applications of mathematics in other disciplines and in the real world, leading to the enhancement of career prospects in aplethora of fields.
6. Appreciate the requirement of lifelong learning through continued education and research.

Course Outcomes

SL. NO.	SEMESTER	PAPER CODE & TITLE	COURSE OUTCOMES	UNIT/CHAPTER	BLOOM'S TAXONOMY LEVELS
1.	I	MAT-HC-1016 Calculus (Including Practical)	This course will enable thestudents to: i) Learn first and second derivativetests for relative extremum and apply the knowledge in problems in business, economics and life sciences. ii) Sketch curves in a plane using itsmathematical properties in different coordinate systems. iii) Compute area of surfaces of	Unit 1 : Higher order derivatives,it's application, geometrical interpretation.	Remember, understand, apply, evaluate.
				Unit 2 : Reduction formula for integration and application of integration in geometry.	Remember, understand, apply, evaluate.
				Unit 3 : Vector functions and it's	Remember, understand, apply,

			revolution and the volume of solidsby integrating over cross-sectional areas. iv) Understand the calculus of vector functions and its use to develop the basic principles of planetary motion.	applications.	evaluate.
2.	I	MAT-HC-1026 Algebra	This course will enable thestudents to: i) Employ De Moivre's theorem in anumber of applications to solve numerical problems. ii) Learn about equivalent classesand 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 echelon formof the augmented matrix. v) Learn about the solution sets oflinear systems using matrix method and Cramer's rule	Unit 1 : Polar representation of complex numbers, De Moivre's theorem and applications.	Remember, understand, apply, evaluate
				Unit 2 : Mathematical logic, sets,functions	Remember, understand, apply, evaluate
				Unit 3 : Relations, Inductionprinciples, GCD of integers	Remember, understand, apply, evaluate
				Unit 4 : Linear equations, matrix and it's applications	Remember, understand, apply, evaluate
3.	II	MAT-HC-2016 Real analysis	This course will enable thestudents to: i) Understand many properties of	Unit 1 : Algebraic and orderproperties of R.	Remember, understand, apply, evaluate

			the real line R, including completeness and Archimedeanproperties. ii) Learn to define sequences interms of functions from N to a subset of R. iii) Recognize bounded, convergent, divergent, Cauchy andmonotonic sequences and to calculate their limit superior, limit inferior, and the limit of a boundedsequence.	Unit 2 : Real sequences and it's convergence	Remember, understand, apply
				Unit 3 : Infinite series and it's convergence	Remember, understand, apply
4.	II	MAT-HC-2026 Differential Equations	The course will enable thestudents to: i) Learn basics of differential equations and mathematicalmodeling. ii) Formulate differential equationsfor various mathematical models. iii) Solve first order non-linear differential equations and lineardifferential equations of higher order using various techniques. iv) Apply these techniques to solve and analyze various mathematical models.	Unit 1 : Basics of MathematicalModel, solution of 1st order differential equations.	Remember, understand, apply, analyse.
				Unit 2: Introduction and analysisof different models.	Understand, apply, evaluate, create
				Unit 3 : Solutions of 2nd orderdifferential equations.	Remember, understand, apply, analyse.

5.	III	MAT-HC-3016 Theory of Real functions	This course will enable thestudents to: i) Have a rigorous understanding ofthe concept of limit of a function. ii) Learn about continuity and uniform continuity of functionsdefined on intervals. iii) Understand geometrical properties of continuous functionson closed and bounded intervals. iv) Learn extensively about the concept of differentiability usinglimits, leading to a better understanding for applications.	Unit 1 : Limit point of sets, limitsof functions.	Remember, understand
				Unit 2 : Continuous functions andrelated theorems	Understand, Remember
				Unit 3 : Differentiability of a function and related theorems	Remember, understand analysis
6.	III	MAT-HC-3026 Group Theory-1	The course will enable thestudents to: i) Recognize the mathematical objects that are groups, and classify them as abelian, cyclic andpermutation groups, etc. ii) Link the fundamental concepts of groups and symmetrical figures. iii) Analyze the subgroups of cyclicgroups and classify subgroups of	Unit 1 : Definition and examplesof group, subgroups, cyclic groups.	Remember, understand, analyse.
				Unit 2 : Permutations, Lagrange'stheorem, normal subgroups and factor groups.	Understand, Remember

			cyclic groups. iv) Explain the significance of the notion of cosets, normal subgroupsand factor groups. v) Learn about Lagrange's theoremand Fermat's Little theorem. vi) Know about group homomorphisms and groupisomorphisms.	Unit 3 : Group homomorphismand related theorems	Remember, understand, analyse.
7.	III	MAT-HC-3036 Analytical Geometry	This course will enable thestudents 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 understandingof the concept of three dimensional coordinates system.	Unit 1 : Transformation of co-ordinates, pair of straight lines, different types of conics with general form.	Remember, understand, analyse, apply.
				Unit 2 : Plane, sphere, cone,cylinder, central conicoid	Remember, understand, apply.
8.	IV	MAT-HC-4016 Multivariate Calculus	This course will enable thestudents to: i) Learn the conceptual variationswhen advancing in calculus from one variable to multivariable discussion. Understand the maximization and minimization of	Unit 1 : Functions of several variables, limit, continuity, partialderivatives, chain rule, level curves, tangent, gradient, directional derivative, total differential.	Remember, understand, apply, analyse, create.
				Unit 2 : Extrema of functions ofseveral variables	Understand, Remember, apply, evaluate.

			multivariable functions subject to the given constraints iii) Learn about inter-relationship amongst the line integral, double and triple integral formulations. ii) Familiarize with Green's, Stokes'and Gauss divergence theorems.		
				Unit 3 : Double and triple integration, volume, area, surfacearea by it.	Remember, understand analyse, apply, create
				Unit 4 : Line , surface integral.Green, Stokes, Divergence theorem and applications.	Apply, analyse, evaluate.
9.	IV	MAT-HC-4026 Numerical Methods (Including Practical)	The course will enable thestudents to: i) Learn some numerical methodsto 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 asFalse position method, Fixed pointiteration method, Newton's method, Secant method and LU decomposition.	Unit 1 : Algorithms, convergence,Solution of system of equations by different methods, LU decomposition	Remember, understand, apply, evaluate.

			iii) Interpolation techniques to compute the values for a tabulatedfunction at points not in the table. iv) Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions		
				Unit 2 : Lagrange and Newton interpolation, finite differenceoperators.	Remember, understand, apply, evaluate.
				Unit 3 : Numerical differentiationand integration. Trapezoidal, Simpson's and Euler's rule.	Understand, apply, analyse, evaluate.
10.	IV	MAT-HC-4036 Ring Theory	This course will enable thestudents to: i) appreciate the significance of unique factorization in rings andintegral domains ii) learn about fundamental concepts of ring, integral domainsand fields. iii) know about ring homomorphism and isomorphismstheorems of rings. iv)learn about polynomial rings over commutative rings and aboutUFD.	Unit 1 : Definition, examples and properties of rings, sub ring, ideal,integral domains, fields. Isomorphisms and homomorphisms of rings andrelated theorems.	Remember, understand, analyse.

				Unit 2 : Polynomial rings over commutative rings, division algorithm, principal and prime ideals, UFD and Euclidean domains, divisibility in integral domains.	Remember, understand, analyse.
11	V	MAT-HC-5016 Complex Analysis (Including Practical)	The course will enable the students to: i) Learn the significance of differentiability of complex functions leading to the understanding of Cauchy–Riemann equations. ii) Learn some elementary functions and can evaluate the contour integrals. iii) Understand the role of Cauchy–Goursat theorem and the Cauchy integral formula and their applications in evaluating complex integrals.	Unit 1 : Function of a complex variable. Limit, continuity, differentiability of complex numbers. Cauchy Riemann equations.	Remember, understand, apply, analyse.
				Unit 2 : Analytic functions, harmonic functions, exponential, logarithmic and trigonometric functions, derivative and definite integral of functions.	Remember, apply, evaluate.
				Unit 3 : Contours, contour integrals and examples	Remember, analyse, apply, evaluate.
				Unit 4 : Antiderivative, Cauchy- Goursat theorem, Cauchy integral formula, Liouville's theorem and fundamental theorem of algebra.	Apply, analyse, evaluate, create.
12.	V	MAT-HC-5026 Linear Algebra	The course will enable the students to: i) Learn about the concept of linear independence of vectors over a field, dimension of a	Unit 1 : Vector spaces, subspaces, null and column space, linear transformations, kernel, range, base, dimension, rank of vector space, change of basis.	Remember, understand, analyse, apply.

			vector space. ii) Basic concepts of linear transformations, dimension theorem, matrix representation ofLT and change of co-ordinate matrix. iii) Compute characteristic polynomial, eigen values, eigen vectors, eigen space. Apply basicdiagonalization results. iv) Compute inner products and determine orthogonality on vectorspaces.		
				Unit 2 : Eigen vectors and eigen values of a matrix, the characteristics equation, diagonalization, eigen vectors of aLT, complex eigen values. Invariant subspaces and CaleyHamilton theorem.	Remember, apply, evaluate.
				Unit 3 : Inner product, length, orthogonality, orthogonal sets and projections. Gram Schmidt process, inner product space. Diagonalization of symmetric matrices and spectral theorem.	Remember, understand, analyse, evaluate.
13.	V	MAT-HE-5016 Number Theory	This course will enable thestudents to: i) Learn about some fascinating discoveries related to the	Unit 1 : Linear Diophantine equation, prime counting function, Goldbach conjecture, linear congruence, residue, dhinese remainder theorem, Fermat's Little theorem,	Remember, understand, analyse.

			properties of prime numbers, andsome of the open problems in number theory, viz.,Goldbach conjecture etc. ii) Know about number theoretic functions and modular arithmetic. iii) Solve linear, quadratic andsystem of linear congruence equations.	Wilson'stheorem.	
				Unit 2 : Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of Dirichlet product, Mobius inversion formula, the greatest integer function, Euler'sphi function, Euler's theorem, residue.	Remember, understand, analyse.
14.	V	MAT-HE-5066 Programming in C (Including Practical)	The course will enable thestudents to: i) Understand and apply the programming concepts of C whichis important to mathematical investigation and problem solving. ii) Learn about structured datatypes in C and learn about different applications Represent the outputs of programs visually in terms of wellformatted text and plots. iii)iv) Practical will enable the	Unit 1 : Variables, constants, different terms related to C and it's library functions, structure ofa C program, input/output functions and statements.	Understand, apply, create.

			students to create and evaluate different problems using C		
				Unit 2 : Control statements, if-else statements, switch statement.	Understand, apply, create.
				Unit 3 : Arrays and subscripted variables, function, function declaration, actual and formal arguments, function prototype,recursive function.	Understand, apply, analyse, create.
15.	VI	MAT-HC-6016 Riemann Integrationand Metric spaces	The course will enable thestudents to: i) Learn about some of the classesand properties of Riemann integrable functions, and the applications of the Fundamental theorems of integration. ii) Know about improper integralsincluding, beta and gamma functions. iii) Learn various natural and abstract formulations of distanceon the sets of usual or unusual entities. Become aware one suchformulations leading to metric spaces. iv) Analyse how a theory advancesfrom a particular frame to a general frame.	Unit 1 : Riemann integration concepts and some related theorems. Concepts of improperintegrals, Gamma functions.	Remember, understand, apply, analyse, evaluate.

			v) Appreciate the mathematical understanding of various geometrical concepts, viz. Balls orconnected sets etc. in an abstractsetting.		
				Unit 2 : Metric spaces, definition, examples sequence and Cauchy sequence, open and closed ball, complete metric space, subspace,dense and separable space.	Remember, Understand, analyse.
				Unit3. Continuous mappings,sequential criterion , uniform continuity, homeomorphism, contraction mapping, connectedness.	Remember, understand analyse.
16.	VI	MAT-HC-6026 Partial Differential Equations (Including practical)	The course will enable thestudents to: i) Formulate, classify and transformfirst 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 orderlinear PDEs.	Unit 1 : Introduction, classification, construction of firstorder PDE, Cauchy problem, Integral surface, Cauchy, Charpit and Jacobi's method of solution.	Remember, understand, analyse, evaluate.

			iv) Learn about Cauchy problem forsecond order PDE and homogeneous as well as nonhomogeneous wave equations.		
				Unit 2 : Canonical form of 1st order PDE, Method of separationof variables	Understand, analyse, apply.
				Unit 3 : Reduction to canonical forms, equations with constant co-efficients, general solution.	Understand, apply, evaluate.
17.	VI	MAT-HE-6046 Hydromechanics	The course will enable thestudents to: i) Know about Pressure equation,rotating fluids. Learn about Fluid pressure on plane surfaces, resultant pressure on curved surfaces, Gas law,mixture of gases iii) Learn about the Eulerian andLagrangian method. ii) Learn about equation of continuity, examples, accelerationof a fluid at a point	Unit 1 : Pressure equation, equilibrium conditions, homogeneous and heterogeneous fluids, rotating fluid, pressure on curved and plane surfaces, centre of pressure, gas, mixture of gases,adiabatic expansion. Unit 2 : Velocity , acceleration of fluid at a point, Lagrangean and Eulerian methods of study of fluidmotion, equation of continuity and equation of motion of fluid.	Remember, understand, analyse. Apply.
			Generic and Regular Course		

18.	I	MAT-HG-1016/ MAT-RC-1016 Calculus	Completion of the course will enablethe students to: i) Understand continuity and differentiability in terms of limit. ii) Describe asymptotic behavior interms of limit involving infinity. iii) Understand importance of Meanvalue theorems. iv) Use derivative to explore behaviorof a function and graphing it.	Unit 1 : Graph of different functions	Understand, apply, analyse, create.
				Unit 2 : Limits and continuity offunctions, properties of continuous functions, intermediate value theorem.	Remember, apply, evaluate.
				Unit 3 : Differentiability, successive differentiation, Leibnitz theorem, higher order derivatives.	Understand, apply, evaluate.
				Unit 4 :. Rolle's Theorem,Lagrange's mean value theorem, geometrical interpretation and application, Taylor;s theorem, Maclaurin's theorem,	Remember, apply, analyse, evaluate.

				Unit 5 : Functions of two and more variables, level curves, partial differentiation.	Understand, apply, create.
19.	II	MAT-HG-2016/ MAT-RC-2016 Algebra	The course will enable the studentsto: i) Learn to solve cubic and biquadraticequations. Also learn relation between the roots and coefficients and it's uses. ii) Employ De Moivre's theorem in a number of applications. iii) Recognize consistent and inconsistent system of equations by row echelon form of matrix. Learn tofind rank and inverse. iv) Learn basic ideas of group, subgroup, permutation group, cyclicgroup and preliminary knowledge ofrings.	Unit 1 : Theory of equations, De Moivre's Theorem, roots ofcomplex numbers.	Remember, understand, apply, evaluate.
				Unit 2 : Matrices, algebra, row echelon and reduced row echelon form, inverse, rank , solution of system of equations.	Understand, apply, evaluate.
				Unit 3 : Groups and rings. Permutation and cyclic groups.	Remember, understand, analyse.

20.	III	MAT-HG-3016/ MAT-RC-3016 Differential Equations	This course will enable the studentsto: i) Learn basics of differential equations and it's applications ii) learn to classify 1st order linear differential equations and differentmethods of solutions. iii) learn to solve 2nd order linearhomogeneous as well as nonhomogeneous differential equations by different methods.	Unit 1 : First order equations and methods of solutions, orthogonal and oblique trajectories, Wronskian and it's properties. Unit 2 : Solutions of 2nd order linear homogeneous and nonhomogeneous equations, Cauchy-Euler equations, simultaneous equations.	Remember, understand, analyse, apply.
21.	IV	MAT-HG-4016/ MAT-RC-4016 Real Analysis	This course will enable the studentsto: i) understand many properties of realline R, including Archimedean and completeness properties. ii) learn to define sequences in termsof functions from R to a subset of R. iii) Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limitsuperior, limit inferior and limits of bounded sequences. iv) learn to apply different tests totest convergence of infinite series.	Unit 1 : Algebraic and order properties of real numbers, open and closed sets. Limits and continuity of a function and their properties, uniform continuity.	Remember, understand, analyse, apply.

				Unit 2 : Sequences, convergent and Cauchy sequences, sub sequences , limits of sequence. Infinite series and convergence.	Remember, understand, apply, evaluate.