TAMRALIPTA MAHAVIDYALAYA

DEPARTMENT OF MATHEMATICS

COURSE OUTCOMES

B.SC. HONOURS

Sl. No.	SEM 1 COURSES	Outcome (within 50 words)
1	Core 1	Topics on Application of Calculus helps us to study about curves and properties of curves like concavity, convexity and tendency of bending. It motivates students to develop the physical concepts(like velocity and acceleration of a moving particles). Reduction formulae help to calculate higher integration. ODEs are used in many models to determine how the state of this model is changing. Demonstrate an intuitive and computational understanding of ODE by solving a variety of application problems arising from biology, chemistry, physics, engineering, economics. Analytical Geometry helps students to understand the geometry of a general equation of second degree in two or three variables.
2	Core 2	• Define and interpret complex numbers, application of De Moviers' Theorem, • Represent complex numbers algebraically and geometrically, • Solve polynomial equations upto degree 4, location and nature of the roots of algebraic equation , • Prove some inequalities and their applications, • Define equivalence relation, partition into equivalence class, • Produce rigorous arguments (proofs) centered on the material of number theory, most notably in the use of Mathematical Induction and/or the Well Ordering Principal in the proof of theorems, • Concept on function, composition on functions, nature of functions and cardinality of two sets, • Define and interpret the concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization, • Solve some problem using congruence relation, • Know division algorithm, divisibility and Euclidean Algorithm, • Use matrix algebra and the related matrices to linear transformations, • Know about rank of a matrix, elementary matrix operation,

		• Know about inverse of a matrix, characterizations of invertible matrices, • Solve the system of linear equations, • Compute and use eigenvectors and eigenvalues, • Compute matrix inversion using Caley –Hamilton theorem. • Compute nature of quadratic expression using matrix transformation.
3	GE1	Topics on Application of Calculus helps us to study about curves and properties of curves like concavity, convexity and tendency of bending. It motivates students to develop the physical concepts(like velocity and acceleration of a moving particles). Reduction formulae help to calculate higher integration. ODEs are used in many models to determine how the state of this model is changing. Demonstrate an intuitive and computational understanding of ODE by solving a variety of application problems arising from biology, chemistry, physics, engineering, economics. Analytical Geometry helps students to understand the geometry of a general equation of second degree in two or three variables.
	SEM 2 **COURSES**	
4	Core 3	• To learn basic procedure and examples in real analysis to be well trained for the courses like Topology, Measure theory and Functional analysis. • To study the concept of countable and uncountable. • To study notion of infimum and supremum which helps to understand the concept of integrations. • To learn the concepts of neighbourhood of a point, interior points, limit points, isolated points, boundary points, open sets, closed sets which helps to understand the concept of limit, continuity and differentiability of a real function. • To study concept of sequence and series and hence find sum of infinite terms with different methods.
5	Core 4	ODEs are used in many models to determine how the state of this model is changing. Demonstrate an intuitive and computational understanding of ODE by solving a variety of application problems arising from biology, chemistry, physics, engineering, economics. Also, Find and interpret the gradient curl, divergence for a function at a given point.Interpret line, surface and volume integrals. Evaluate integrals by using Green's Theorem, Stokes theorem, Gauss's Theorem.
6	GE 2	• Define and interpret complex numbers, application of De Moviers' Theorem, • Represent complex numbers algebraically and geometrically, • Solve polynomial equations upto degree 4, location and

		nature of the roots of algebraic equation , • Prove some inequalities and their applications, • Define equivalence relation, partition into equivalence class, • Produce rigorous arguments (proofs) centered on the material of number theory, most notably in the use of Mathematical Induction and/or the Well Ordering Principal in the proof of theorems, • Concept on function, composition on functions, nature of functions and cardinality of two sets, • Define and interpret the concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization, • Solve some problem using congruence relation, • Know division algorithm, divisibility and Euclidean Algorithm, • Use matrix algebra and the related matrices to linear transformations, • Know about rank of a matrix, elementary matrix operation, • Know about inverse of a matrix, characterizations of invertible matrices, • Solve the system of linear equations, • Compute and use eigenvectors and eigenvalues, • Compute matrix inversion using Caley –Hamilton theorem. • Compute nature of quadratic expression using matrix transformation.
	SEM 3 **COURSES**	
7	Core 5	It analyzes the basic nature of functions which is defined in any Domain Set including interval of R. it can also be used to analyze the local behavior of functions near points of interest. We can know about continuity of a curve and its smoothness (by differentiation). We can expand some functions in infinite series.To understand the concept of metric and metric spaces, pseudometric spaces, limit points, interior points, open sets, closed sets. Understand Holders and Minkowski inequalities and also define and illustrate the concept of separable spaces.
8	Core 6	• Assess properties implied by the definitions of groups • Use various canonical types of groups (symmetry of a square, dihedral group, quaternion groups) • Analyze and demonstrate examples of subgroups, normal subgroups and quotient groups, • Analyze and demonstrate cetralizer, normalize, center of group, • Analyze product of two subgroups, Cosets • proofs of propositions on cyclic groups, cyclic sub- groups

		• Analyze and demonstrate permutation group, properties of permutation groups, • Prove Lagrange theorem and Farmat's little theorem, Cauchy theorem on finite abelian groups, • Realize homomorphism and its properties, • Prove the isomorphism theorems and also Caley's theorem,
9	Core 7	• To measure the error calculation and implementation • To learn the interpolation methods • To solve non-linear equations using recurrence formula • To solve system of linear equations using recurrence formula • To learn differentiation and integration using numerical methods • To solve differential equations using numerical methods. • To able to write MATLAB programming of all these numerical methods.
10	SEC 1	The student will learn concepts like finite state machine, Boolean algebra, lattice which develop more useful logic in the development of theories of electronic computers, networks, switching circuits that are applicable in physics.
	SEM 4 **COURSES**	
11	Core 8	We analyze whether a function is integrable or not by algebraic method. The value of Integration of a bounded function (it may have finite or infinite numbers of discontinuity) on a closed interval is also realized. We also study the integration of a function which is not bounded. We study pointwise and uniform convergence of sequence of functions and series of functions. We investigate the properties of limit function.
12	Core 9	Demonstrate the concept and use of partial differentiation in various problems. Identify the rough sketch of curves in various coordinates system. Vector differentiation and integration applied to problems in fluid mechanics.
13	Core 10	After completion of the course, students will able to • study the algebraic structure Ring in detail through various examples. • learn the construction of field of quotients of an integral domain. • study the Rings of polynomials and its factorization over a field. • study the notion of ideals and factor rings with examples. • study Unique Factorization domain, Euclidean Domain and related results • Define Vector Space, Quotient space Direct sum, linear span and linear independence, basis and inner product. • Discuss the linear transformations, rank, nullity.

		• Find the characteristic equation, eigenvalues and eigenvectors of a matrix. • Prove Cayley- Hamilton theorem, Schwartz inequality, Gramschmidt orthogonalisation process. • Solve the system of simultaneous linear equations.
14	SEC 2	• Able to define the basic concepts of graphs, directed graphs, and weighted graphs • Able to define the properties of bipartite graphs, particularly in trees. • Able to understand Eulerian and Hamiltonian graphs • Able to understand the concept of plane graph and theory.
	SEM 5 **COURSES**	
15	Core 11	Formulate physical problems as PDEs using conservation laws. Understand analogies between mathematical description of different (wave) phenomena in physics and engineering. Classify PDEs, apply analytical methods, and physically interpret the solution.
16	Core 12	After completion of the course, students will able to • Study the concepts of automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups. • Apply the factor groups to automorphism groups. • Study the Characteristic subgroups, Commutator subgroup and its properties. • Understand several properties of external direct products, the group of units modulo n as an external direct product, internal direct products, and also the fundamental theorem of finite abelian groups. • Learn group actions, stabilizers and kernels, permutation representation associated with a given group action. • Apply the group actions. • Study the generalized Cayley's theorem. Index theorem. • Understand the concepts of class equation and consequences, conjugacy in Sn, p-groups, Sylow's theorems and consequences, Cauchy's theorem, and simplicity of An for $n \geq 5$, non-simplicity tests.
17	DSE 1	Upon successful completion of **LPP** - Linear Programming and Operations Research, a student will be able to: • Formulate and model a linear programming problem from a word problem and solve them graphically in 2 and 3 dimensions, while employing some convex analysis, • Place a Primal linear programming problem into standard form and use the Simplex Method or Revised Simplex Method to solve it, • Find the dual, and identify and interpret the solution of the Dual Problem from the final tableau of the Primal problem,

		• Be able to modify a Primal Problem, and use the Fundamental Insight of Linear Programming to identify the new solution, or use the Dual Simplex Method to restore feasibility, • Interpret the dual variables and perform sensitivity analysis in the context of economics problems as shadow prices, imputed values, marginal values, or replacement values, • Explain the concept of complementary slackness and its role in solving primal/dual problem pairs, • Classify and formulate integer programming problems and solve them with cutting plane methods, or branch and bound methods, and • Formulate and solve a number of classical linear programming problems and such as the minimum spanning tree problem, the assignment problem, (deterministic) dynamic programming problem, the knapsack problem, the XOR problem, the transportation problem, the maximal flow problem, or the shortest-path problem, while taking advantage of the special structures of certain problems.
18	DSE 2	Upon successful completion of DSE 2– Probability & Statistics, a student will be able to: • Recognize the role of probability theory, descriptive statistics and inferential statistics in the applications of many different fields, • Define and illustrate the concepts of sample space, events and compute the probability and conditional probability of events, and use Bayes' Rule, • Define, illustrate and apply the concepts of discrete and continuous random variables, the discrete and continuous probability distributions and the joint probability distributions, • Apply Chebyshev's theorem, • Define, illustrate and apply the concept of the expectation to the mean, variance and covariance of random variables, • Define, illustrate and apply certain frequently used discrete and continuous probability distributions, and • Illustrate and apply theorems concerning the distributions of functions of random variables and the moment-generating functions. • Recall the basic concepts in probability and statistics and understand the concept of the transformation of variables and moment-generating functions, • Define and examine the random sampling (population and sample, parameters and statistic) data displays and graphical methods with technology, • Recognize and compute the sampling distributions, sampling distributions of means and variances (S2) and the

		t- and F-distributions, • Understand, apply and compute in one- and two- sample estimation problems, • Understand, apply and compute maximum likelihood estimation, • Understand, apply and compute in one- and two- sample tests of hypotheses problems, • Recognize the relationship between the confidence interval estimation and tests of hypothesis, • Understand, apply and examine the goodness-of-fit test, test for independence, and homogeneity, • Recognize the basic concepts of simple linear regression and correlation
	SEM 6 **COURSES**	
19	Core 13	• To enhance abstract thinking and visualization of students. • To generalize the notion of distance, convergent sequence and continuity of functions. • To increase problem solving ability by solving examples and counter-examples of various concepts involved. • To understand the modulus of a Complex valued function and results regarding that • To understand and learn to use Argument Principle. • To understand the analytic functions, Harmonic functions on a disc and concerned results. • To understand the factorization of entire functions having infinite zeros.
20	Core 14	
21	DSE 3	We study moment of inertia and product of inertia of a rigid body. We have also learned general motion of a rigid body and motion of centre of Inertia as well as motion about centre of inertia. The motion of a rigid body under finite forces and Impulsive forces is also considered.The primary purpose of the study of mechanics is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions.
22	DSE 4	We have solved differential equations with help of Laplace Transform. The particular types of Differential Equation (Bessel equation, Legendre equation) has solve by series solution method. The Properties of Besell Equation and Legendre Polynomial is also discussed. We have studied Simulation Techniques and Algorithm to solve some mathematical problems.

B.SC. GENERAL

Sl. No.	**COURSES**	Outcome (within 50 words)
SEM 1	Core-1 (DSC-1A) Differential Calculus	Topics on Application of Calculus helps us to study about curves and properties of curves like concavity, convexity and tendency of bending. It motivates students to develop the physical concepts (like velocity and acceleration of a moving particles). Reduction formulae help to calculate higher integration.
SEM 2	Core-4 (DSC-1B) Differential Equations	ODEs are used in many models to determine how the state of this model is changing. Demonstrate an intuitive and computational understanding of ODE by solving a variety of application problems arising from biology, chemistry, physics, engineering, economics. Analytical Geometry helps students to understand the geometry of a general equation of second degree in two or three variables.
SEM 3	Core-7 (DSC-1C) Real Analysis	We analyze whether a function is integrable or not by algebraic method. The value of Integration of a bounded function (it may have finite or infinite numbers of discontinuity) on a closed interval is also realized. We also study the integration of a function which is not bounded. We study pointwise and uniform convergence of sequence of functions and series of functions. We investigate the properties of limit function.
	SEC-1 Logic & Set	The student will learn concepts like finite state machine, Boolean algebra, lattice which develop more useful logic in the development of theories of electronic computers, networks, switching circuits that are applicable in physics.
SEM 4	Core-10 (DSC-1D) Algebra	• Assess properties implied by the definitions of groups • Use various canonical types of groups (symmetry of a square, dihedral group, quaternion groups) • Analyze and demonstrate examples of subgroups, normal subgroups and quotient groups, • Analyze and demonstrate cetralizer, normalize, center of group,

		• Analyze product of two subgroups, Cosets • proofs of propositions on cyclic groups, cyclic sub- groups • Analyze and demonstrate permutation group, properties of permutation groups, • Prove Lagrange theorem and Farmat's little theorem, Cauchy theorem on finite abelian groups, • Realize homomorphism and its properties, Prove the isomorphism theorems and also Caley's theorem,
SEM 5	DSE-1A Discipline-1 (Matrices)	• Use matrix algebra and the related matrices to linear transformations, • Know about rank of a matrix, elementary matrix operation, • Know about inverse of a matrix, characterizations of invertible matrices, • Solve the system of linear equations, • Compute and use eigenvectors and eigenvalues, • Compute matrix inversion using Caley –Hamilton theorem. • Compute nature of quadratic expression using matrix transformation.
SEM 6	DSE-1B Discipline-1(LPP)	• Formulate and model a linear programming problem from a word problem and solve them graphically in 2 and 3 dimensions, while employing some convex analysis, • Place a Primal linear programming problem into standard form and use the Simplex Method or Revised Simplex Method to solve it, Find the dual, and identify and interpret the solution of the Dual Problem from the final tableau of the Primal problem • Be able to modify a Primal Problem, and use the Fundamental Insight of Linear Programming to identify the new solution, or use the Dual Simplex Method to restore feasibility, • Interpret the dual variables and perform sensitivity analysis in the context of economics problems as shadow prices, imputed values, marginal values, or replacement values, • Explain the concept of complementary slackness and its role in solving primal/dual problem pairs,