

## Mathematics

Course	Course Outcomes
CC1: Calculus, Geometry & Vector Analysis	<p>CO1 - Realizing the concept of differentiation and integration.</p> <p>CO2 - Applications of differentiation include measuring velocity, acceleration, etc.</p> <p>CO4 - Applications of integration include estimating areas, volumes, etc.</p> <p>CO5 - Introducing the concepts of distance between two points, slope and transformations of origin.</p> <p>CO6 - Visualize various forms of straight lines, planes, conic sections.</p> <p>CO7 - It is used widely in Mechanics and Astronomy.</p> <p>CO8 - To study vectors triple product, equations and its applications in geometry and mechanics.</p> <p>CO9 – Basic knowledge of limits and continuity of vector functions and also its differentiation and integration.</p>
CC2: Algebra	<p>CO1 - Understanding of complex numbers, theory of equations, inequality and linear difference equations.</p> <p>CO2 - Linear equations are vital for solving any differential equations.</p> <p>CO3 - Many areas of Numerical analysis depend upon linear equations.</p> <p>CO4 - Specific fields of applications are computer graphics, Cryptography etc.</p> <p>CO5 - Introduce relation, mapping and some properties of positive integers.</p> <p>CO6 - Understanding of matrix operations further its applications to solve linear equations</p>
CC3: Real Analysis	<p>CO1 - It is an important part of pure mathematics to increase the knowledge of real numbers.</p> <p>CO2 - Understand the mathematical operations, ordering, boundedness, dense, limiting, closure and compactness properties of real numbers.</p> <p>CO3 - Introduce the knowledge of Bolzano-Weirstrass theorem.</p> <p>CO4 - To study sequences and its boundedness and convergence property.</p> <p>CO5 - To study series of real functions, Fourier series, half range series.</p>
CC4: Group Theory-I	<p>CO1 - Algebra is science of operations.</p> <p>CO2 - To understand the concept of groups, normal subgroups and permutations.</p> <p>CO3 - Visualize the homomorphism and isomorphism concept.</p>

	CO4 - It is widely used in Computer science and I.T.
CC5: Theory of Real Functions	CO1 – Understand the concept of limits and continuity of functions. CO2 – Then clear the concept of differentiability of functions. CO3 – Introduce the concept of boundedness, discontinuity, uniform continuity. CO4 – Introduce the Darboux theorem, Rolle’s theorem, Mean value theorems of Lagrange and Cauchy and applications. CO5 – Conditions of local extreme points and applications in geometry.
CC6: Ring Theory & Linear Algebra-I	CO1 - To under the structure of ring and integral domain, quotient and polynomial rings. CO2 - To learn about vector spaces, it basis and dimension. CO3 - To know about eigen values and eigen vectors. CO4 - To study linear transformations. CO5 - It is widely used in Computer science and I.T.
CC7: Ordinary Differential Equation & Multivariate Calculus-I	CO1 - To understand the importance of ordinary differential equation. CO2 - It is used in solving many problems of engineering and physics. CO3 - To study existence and uniqueness about solutions. CO4 - To learn about exact differential equations and various types. CO5 -To learn about second order linear differential equations. CO6 - To study series solution method to solve differential equations. CO7 – Limit and continuity of functions of two or more variables and their applications in optimization problem
CC8: Riemann Integration & Series of Functions	CO1 – To learn basics of Reimann integration and fundamental of Integral calculus. CO2 – Basic concept of improper integral and its convergency test. CO3 – Knowledge of Beta and Gamma functions CO4 - To learn mean value theorem of integral calculus. CO5 – To know basics of sequence of functions, boundedness, continuity, differentiability and integrability of it. CO6 - To understand the importance of Legendre polynomials.

	CO7 – Concept of series of functions, fundamental theorem of power series and Fourier series are introduced
CC9: Partial differential equation & Multivariate Calculus-II	CO1 – To understand the importance of partial differential equations. CO2 - To study about linear partial differential equations. CO3 - To learn about the simultaneous differential equations. CO4 - To understand the methods of solution for total differential equations. CO5 - To study properties of Beta and Gamma functions. CO6 - To learn about differentiation and integration of vectors. CO7 - To understand the concepts of gradient, divergence and curl. CO8 -To know the importance of Stokes theorem, Gauss divergence theorem and green's theorem to interchange among the line, surface and volume integration.
CC10: Mechanics	CO1 - It gives an introductory knowledge of relative motion, inertial, non-inertial reference frames, the motion of mechanical systems and their degrees of freedom. CO2 - Newton's laws of motion and conservation principles. CO3 - It gives a vast idea to solve problem in particle dynamics in linear, planar system. CO4 - An introductory knowledge of linear and angular momentum, the energy principle, collision of bodies.
CC11: Probability & Statistics	CO1 - To learn classical probability, and different distributions. CO2 - It is used in real life events which follows new distributions CO3 - Understanding the process of sampling, estimation of parameter of population. CO4 - To learn to test statistical hypothesis and its various aspects. CO5 - To understand various statistical measures.
CC12: Group Theory-II & Linear Algebra-II	CO1 - To understand the concept of automorphism, external direct product. CO2 – Visualize inner product spaces and norms, Bilinear and quadratic forms. CO3 – Introduce the concept of Diagonalisation of symmetric matrices, Hessian matrix, Sylvester's law of inertia. Index, signature. CO4 - To understand the concept of dual spaces, dual basis, double dual.

	CO5 - Eigenspaces of a linear operator, diagonalizability, and canonical forms also introduce.
CC13: Metric Space & Complex Analysis	CO1 - To learn properties of complex numbers. CO2 - To understand the use of complex numbers in the field of Calculus. CO4 - To learn the importance of analytic functions, singularities and residues. CO5 - To apply the knowledge of residues in complex integration. CO6 - It is used in fixed point theorem and mapping principles. CO7 - To study continuous functions on metric spaces, connected metric spaces, complete metric spaces and compact metric spaces.
CC14: Numerical Methods	CO1 - To learn how to interpolate the given set of values. CO2 - Introducing the rounding numbers, significant digits and error propagation. CO3 - It is used for solving a system of linear equations, the roots of transcendental and algebraic equations. CO4 - To understand the curve fitting for various polynomials. CO5 - To learn numerical solution of differential equations. CO6 - To learn numerical differentiation and integration. CO7 - To learn about interpolation polynomials. CO8 - It is used for solving a system of equations and used in all branches of engineering.
DSE - A(1)-1: Advanced Algebra	CO1 - To understand the concept of group actions, Generalized Cayley's theorem, Index theorem. CO2 - Introduce Sylow's theorems and consequences. CO3 - Basic concepts of Principal ideal domain, principal ideal ring, prime element, irreducible element, greatest common divisor, least common multiple. CO4 - To learn polynomial rings, division algorithm and consequences. CO5 - To know basics of Ring embedding and quotient field.
DSE - B(1)-2: Linear Programming & Game Theory	CO1 - Optimization techniques is a branch of Operations Research. CO2 - It deals with minimization of cost or maximization of profit. CO3 - It is used in Production engineering, Mathematics of finance, Networking, etc.

	<p>CO4 - To study linear programming problems, transportation and assignment problems.</p> <p>CO5 - To know the fundamentals of game theory.</p> <p>CO6 - It introduces the simplex method to solve various problems.</p>
DSE - A(2)-2: Mathematical Modelling	<p>CO1 - To know Method of changing equations from one form to another easier form</p> <p>CO2 - It is used to solve both ordinary and partial differential equations.</p> <p>CO3 - Applications are in all branches of engineering.</p> <p>CO4 - To learn properties of Laplace transforms.</p> <p>CO5 - To learn properties of inverse Laplace transforms.</p> <p>CO6 - Overview of optimization modelling and linear programming model: geometric solution algebraic solution, simplex method, sensitivity analysis</p> <p>CO7 - It gives some introductory concept of Monte Calo simulating modelling.</p> <p>CO8 – Introduce basic models of queuing theory.</p>
DSE-B(2)-1: Point Set Topology	<p>CO1 - To understand the basics of General Topology.</p> <p>CO2 - To know the generalisation of metric space.</p> <p>CO3 - To study open sets, closed sets, dense sets, compactness, connectedness, nature of continuity in a generalised set up</p>
SEC – A: C Programming Language	<p>CO1 - It introduces the basic ideas of C program.</p> <p>CO2 - It helps to write a C program using code.</p> <p>CO3 - It helps to solve numerical methods using programming.</p>
SEC – B: Scientific computing with SageMath & R	<p>CO1 - To know basics ideas how to use these softwires.</p> <p>CO2 - Some useful commands to do some basic maths, plot easily.</p> <p>CO3 - It helps to solve some complex numerical problems using program code.</p>