Course Outcome, Dept. of Mathematics

Course Title:- C1T: Calculus, Geometry & Differential Equation

CO1. Describe Leibnitz rule and its application to various problems.
CO2. Write Down L'Hospital's rule with applications in business, economics and life sciences.
CO3. Illustrate reduction formula for different types of functions.
CO4. Classification of conics.
CO5. Write down general, particular, explicit, implicit and singular solutions of a differential equation.
CO6. Illustration of exact differential equation and integrating factors.
CO7. Reduction to separable differential equation.
CO8. Describe linear equation and Bernoulli differential equations.

Course Title:- C2T: Algebra

CO1.Representation of complex numbers in polar forms.
CO2. Write Down De Moivre's theorem with rational indices with applications.
CO3. Identify relation between roots and co-efficients.
CO4. Describe different types of inequalities.
CO5. Describe equivalence relation, well-ordering property of positive integers.
CO6. Write down division algorithm, congruence relation, principles of mathematical induction.
CO7. Representation of linear system of equations in matrix form and derivation of solutions.
CO8. Describe linear transformation.
CO9. Identify rank of a matrix, eigen values, eigen vectors, characteristics equation of a matrix.
CO10. Describe Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

Course Title:- C3T: Real Analysis

CO1.Describe Algebraic and order properties of R.
CO2. Classification of different types of sets.
CO3. Describe completeness property, Archimedean property and density property of real numbers.
CO4. Describe Bolzano-Weierstrass theorem and Heine-Borel theorem.
CO5. Classification of real sequences with examples.
CO6. Describe convergence and divergence of sequences, Cauchy's criterion for convergence.

CO7. Describe convergence and divergence of real series, Cauchy's criterion for convergence.
CO8. Write down different tests for convergence of series with examples.
CO9. Describe alternating series, absolute and conditional convergence.
CO10. Write down Leibnitz test with examples.

Course Title:- C4T: Differential Equations & Vector Calculus

CO1.Describe Lipschitz condition and Picard's method.
CO2. Solution of Linear homogeneous and non-homogeneous equations of higher order with constant coefficients.
CO3. Describe method of undetermined coefficients, method of variation of parameters for solving differential equation.
CO4. Solution and classification of systems of linear differential equations.
CO5. Write down Power series solution of a differential equation about an ordinary point and solution about a regular singular point.
CO6. Describe vector triple product with examples.
CO7. Describe limits, continuity, differentiation and integration of vector functions

Course Title:- C5T: Theory of Real Functions & Introduction to Metric Space

CO1.Describe sequential criterion for limits with examples.
CO2. Describe sequential criterion for continuity and discontinuity with examples.
CO3. Describe differentiability of a function at a point and in an interval.
CO4. Write down Rolle's theorem, mean value theorems with applications of mean value theorem to inequalities and approximation of polynomials.
CO5.Ellustrateintermediate value property of derivatives, Darboux's theorem.
CO6. Write down Taylor's theorem with Lagrange's form of remainder, Cauchy's form of remainder.
CO7. Expansion ofTaylor's series and Maclaurin's series.
CO8. Describe metric spaces with examples.

Course Title:- C6T: Group Theory I

CO1.Describe different groups including permutation groups and quaternion groups (through matrices), symmetries of a square, dihedral groups with examples.
CO2. Describe subgroups with examples.
CO3. Classification of subgroups of cyclic groups.

CO4. Write down Lagrange's theorem and consequences including Fermat's Little theorem.
CO5.Ellustratenormal subgroups Cauchy's theorem for finite abelian groups.
CO6. Describe properties of homomorphisms, first, second and third isomorphism theorems.
CO7. Describe Cayley's theorem.

Course Title:- **C7T: Numerical Models**

CO1.Classification of different types of errors.
CO2. Describe bisection method, Newton's method, Secant method, Regula-falsi method, fixed point iteration, Newton-Raphson method.
.CO3. Describe rate of convergence of these methods.
CO4. Write down Gaussian elimination, Gauss Jordan methods, Gauss Jacobi method, Gauss Seidel method and their convergence analysis.
CO5.Ellustrate Lagrange and Newton's methods of interpolation.
CO6. Describe Numerical differentiation.
CO7. Describe Newton Cotes formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpsons 3/8th rule, Weddle's rule, Boole's Rule. midpoint rule, composite Trapezoidal rule, composite Simpson's 1/3rd rule, Gauss quadrature formula for numerical Integration.
CO8. Describe the method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four for solving ordinary differential equations.

Course Title:- **C8T : Riemann Integration and Series of Functions**

CO1. Apply the knowledge of convergence to problems and the various theorems on convergence, absolute convergence and conditional convergence
CO2. Understand partitions and their refinement
CO3. Understand Integrability and theorems on integrability
CO4. Acquire the idea about Riemann Integrability and Riemann Integration and Understand various theorems associated with Riemann Integration
CO5.Develop skill in checking the uniform convergence of series using various tests of convergence
CO6. Distinguish between Pointwise convergence and Uniform Convergence
CO7. Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability

Course Title:- **C9T: Multivariable Calculus**

CO1. Learn conceptual variations while advancing from one variable to several variables in calculus.
CO2. Apply multivariable calculus in optimization problems.
CO3. Inter-relationship amongst the line integral, double and triple integral formulations.
CO4. Applications of multivariable calculus tools in physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.
CO5. Realize importance of Green, Gauss and Stokes' theorems in other branches of mathematics.

Course Title:- **C10T: Ring Theory and Linear Algebra**

CO1. Know the fundamental concepts in ring theory such as the concepts of ideals, quotient rings, integral domains, and fields.
CO2. Learn in detail about polynomial rings, fundamental properties of finite field extensions, and classification of finite fields.
CO3. Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.
CO4. Relate matrices and linear transformations, compute eigen values and eigen vectors of linear transformations.
CO5. Learn properties of inner product spaces and determine orthogonality in inner product spaces.
CO6. Realise importance of adjoint of a linear transformation and its canonical form

Course Title:- **C11T: Partial Differential Equations & Applications**

CO1. To understand the concept of Partial differential Equations in more than two variables.
CO2. Be familiar with the modeling assumptions and derivations that lead to PDEs.
CO3. Recognize the major classification of PDEs and the qualitative differences between the classes of equations.
CO4. Apply a range of techniques to solve first & second order partial differential equations.
CO5. Model physical phenomena using partial differential equations such as the heat and wave equations.

Course Title:- **C12T : Group Theory II**

CO1. To learn fundamental properties and mathematical tools such as closure, identity, inverse and generators.

CO2. To study algebraic structure 'Groups' in detail which is useful in study of Rings, Modules, Algebraic topology, Analysis
CO3. To enhance abstract thinking of students.
CO4. To learn to compare two different algebraic structures and study transfer of properties in between these structures through homomorphism and isomorphism
CO5. Understand the basic concepts of group actions and their applications.
CO6. Recognize and use the Sylow theorems to characterize certain finite groups.

Course Title:- **C13T: Metric Spaces and Complex Analysis**

CO1. To equip students with basic mathematical tools such as open & close sets, continuity, connectedness, compactness which can be used to study general topology and real & complex analysis.
CO2. To enhance abstract thinking and visualization of students.
CO3. To generalize the notion of distance, convergent sequence and continuity of functions.
CO4. To increase problem solving ability by solving examples and counter-examples of various concepts involved.Learn basic facts about the cardinality of a set
CO5. Understand several standard concepts of metric spaces and their properties like openness, closed ness, completeness, Bolzano-Weierstrass property, compactness, and connectedness.
CO6. Identify the continuity of a function defined on metric spaces
CO7. Visualize complex numbers as points of plane and stereographic projection of complex plane on the Riemann sphere.
CO8. Understand the significance of differentiability and analyticity of complex functions leading to the Cauchy Riemann equations.

Course Title:- **C14T: Ring Theory and Linear Algebra II**

CO1: To study the algebraic structure Ring in detail through various examples.
CO2: To learn the construction of field of quotients of an integral domain.
CO3: To study the Rings of polynomials and its factorization over a field.
CO4: To study the notion of ideals and factor rings with examples.
CO5: To study Unique Factorization domain, Euclidean Domain and related results
CO6: To learn the importance of linear transformation in Physics, Engineering, Social sciences and various branches of Mathematics.
CO7: To learn to find Eigen values and Eigen vectors of a matrix which is used in the study of vibrations, chemical reactions and geometry.
CO8: To learn Inner Product spaces and Gram-Schmidt process of orthogonalization.
CO9: To get well equipped with Mathematical Modelling abilities.

Course Title:- **SEC1: Logic and Set**

CO1: Learn propositions, truth table and logical operators
CO2: Get basic idea about Propositional equivalence, Predicates and quantifiers:
CO3: Learn to mathematicize daily life incident using mathematical logic.

Course Title:- **SEC2: Graph Theory**

CO1: Solve problems using basic graph theory
CO2: Identify various types of graphs e.g., path, cycle, tree etc.
CO3: identify whether graphs are Hamiltonian and/or Eulerian
CO4: Representation of graph using computer
CO5: Model real world problems using graph theory

Course Title:- **DSE1T: Linear Programming Problem**

CO1: Explain basic concepts of optimization, modelling and linear modeling. Explain the mathematical background of LP.

CO2: Formulate the decision making problems by using LP techniques. Idea of the feasible solution, optimal solution and basic feasible solution

CO3: Solve LP models by using simplex Two-phased and Big M methods

CO4: Construct the dual model of a given LP model

CO5: Solve Transportation and assignment problems

CO6: Get idea of game theory. Solve two persons zero sum game.

Course Title:- **DSE2T: Probability & Statistics**

CO1: Foundations of probabilistic and statistical analysis mostly used in various branch of science.

CO2: Determine probabilities and derive the marginal and conditional distributions.
CO3: Use the basic probability rules such as addition and multiplication laws.
CO4: Derive the probability density function of transformation of random variables.

CO5: Analysis of statistical data graphically using frequency distributions and cummulative frequency distributions.
CO6: Analysis of statistical data using measures of central tendency.

Course Title:- DSE3T: Mechanics

CO1: Learner should understand to determine the resultant of forces and/or moments
CO2: Introduction to analytical mechanics as a systematic tool for problem solving.
CO3: Understand friction, work and energy, virtual work.
CO4: Calculate the principal moment of inertia of plane areas.
CO5: Solve problems arise in motion of artificial satellite
CO6: Able to solve problems of motion in resisting medium

Course Title:- DSE4T: Mathematical Modeling

CO1: Construct a mathematical model of a given physical system and analyze it
CO2: Make predictions of the behaviour of a given physical system based on the analysis of its mathematical model.
CO3: Identify the relationships between different areas of mathematics and the connections between mathematics and other disciplines.
CO4: Model real-world problems mathematically and analyze those models using their mastery of the core concepts.