COURSE CODE: 6SMMA101

Advance Abstract Algebra

COURSE OBJECTIVES:-

- This course aims to provide a first approach to the subject of algebra, which is one of the basic pillars of modern mathematics.
- The focus of the course will be the study of certain structures called groups, rings, fields and some related structures.
- In particular to study in details the Sylow theorems and polynomials rings.
- This course helps to gain skill in problem solving and critical thinking.
- Abstract algebra is a classical field that is associated with the study of polynomials in several variables.

Syllabus:

UNIT - I Normal and subnormal series of group, composition series of group, Jordan- holder theorem.

UNIT - II Solvable and Nilpotent groups,

UNIT - III Field & subfield definition & Examples, Extension fields, Algebraic extensions, Separable and Inseparable extensions Normal extension, Perfect fields

UNIT – IV Class equation of finite group, Cauchy's theorem for finite groups, Sylow Theorem, Wilson's Theorem, Lagrange's Theorem.

UNIT – V Polynomial Ring R[x] over a Ring R in an indeterminate X, Primitive polynomial .The ring of Gaussian integers as an Euclidean domain, Fermat's Theorem, Unique Factorization domain.

COURSE OUTCOMES:-

- The student will be able to define the concepts of group, ring, field, and will be able to readily give examples of each of these kinds of algebraic structures.
- The student will be able to define the concepts of coset and normal subgroup and to prove elementary propositions involving these concepts.
- The student will be able to define the concept of subgroup and will be able to determine (prove or disprove), in specific examples, whether a given subset of a group is a subgroup of the group.
- The student will be able to define and work with the concepts of homomorphism and isomorphism.
- The student will be able to apply the basic concepts of field theory, including field extensions and finite fields.

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COURSE CODE: 6SMMA102

Real Analysis -I

COURSE OBJECTIVES:-

- The goal of this course is for students to gain proficiency in convergence, test of sequences and series of real numbers.
- To familiarize the student with open set and closed set of real numbers.
- To make the student acquire sound knowledge of techniques in solving differential calculus.

Syllabus:

UNIT – I Sequences & subsequences, Convergent sequence, divergent sequence and some theorems, Real Valued function & Theorems, Cesaros's Theorem, Nested Interval theorem, Limit superior and Limit Inferior.

UNIT – II Series of Non-negative terms, comparison test, cauchy's condensation test, comparison of ratios, Logarithmic test, D'morgan and bertrand's test.

UNIT – III General Principal of convergence, pringsheims Method, Merten's Theorem, Abel's Theorem, Euler's constant Theorem.

UNIT – IV Neighbourhoods, open set and closed set & properties, Bolzano-weierstranss Theorem, Baire category theorem for R, covering Theorem.

UNIT – V Limit and continuity Theorems on continuity, Bolzano's theorem on continuity, continuity of inverse function, Geometrical meaning of a derivative, chain Rule of Derivative, Darboux Theorem and cauchy's mean value Theorems

COURSE OUTCOMES:-

- Fluency in convergence test using standard methods, including the ability to find an appropriate test for a given sequence or series.
- Understanding ideas and concept of differential calculus and facility in solving standard examples.
- Understanding the ideas of open and closed sets and facility in solving standard examples

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COURSE CODE: 6SMMA103

Topology-I

COURSE OBJECTIVES:-

The aim of this course is to provide students

- An introduction to theory of metric and topological spaces with emphasis on those topics that are important to higher mathematics.
- Basic notions of metric and topological spaces.
- Information about the properties of continuous mappings and convergence in topological spaces.
- The broader information of some selected types of topological spaces (compact, product, connected spaces) and count ability, separation axioms including some basic theorems on topological spaces.
- Information about product invariance of certain separation and count ability axioms.

Syllabus:

UNIT – I Definition and examples of topological space, Open sets, Closed sets , Closure , Dense subsets.

UNIT – II Neighborhoods, Interiors, exteriors and boundary .Accumulation point and derived sets, bases and sub-bases, subspaces and relative topology.

UNIT – III Continuous Maps, Continuous Maps into R, open and closed maps, Homeomorphism, Finite product spaces, projection maps.

UNIT – IV Connected space and disconnected spaces, separated sets, component, locally connected space, Path connectedness, separation axioms : T0, T1 and T2 Spaces.

UNIT – V Introduction of compactness, compact subspace, Finite intersection property, Bolzano-weierstrass property, countable, sequential and local compactness.

COURSE OUTCOMES:-

Upon successful completion of the program the students will be aware of:-

- The definitions of standard terms in topology.
- How to read and write proofs in topology with a variety of examples and counter examples.
- Some important concepts like continuity, compactness, connectedness, projection mapping etc
- Count ability, separation axioms and convergence in topological spaces.
- Using new ideas in mathematics and also help them in communicating the subject with other subjects.

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COURSE CODE: 6SMMA104

Complex Analysis –I

COURSE OBJECTIVES:-

- To tell more about complex numbers and complex valued function to the students.
- To introduce the concept of conformal mapping and Bilinear transformation of different kind.
- To introduce the concept of complex integration on simply connected region and multiple connected region.
- To introduce three main and important theorem of Complex Analysis namely Liouvilles theorem, Morera's theorem and Cauchy's integral formula.
- To introduce Taylor's series and Laurent's series to the students.

Syllabus:

UNIT – I Complex Number, Analytic Functions, Cauchy – Riemann Equations, Harmonic Functions, Conjugate functions.

UNIT – II Conformal mappings, Bi-linear transformations, Geometrical interpretations of the transformations $\omega = z+\alpha$, $\omega = \beta z$, $\omega = \gamma z$. Bilinear transformation of a circle.

UNIT – III Complex integration, complex integrals as sum of two real line integrals, Cauchy's Theorem, Extension of Cauchy's Theorem to multi – connected region Cauchy.

UNIT – IV Cauchy integral formula, Extension of cauchy's integral formula to multiconnected regions, Liouville's Theorem, Morea's theorem.

UNIT – V Taylor's Theorem, Laurent's Theorem with examples.

COURSE OUTCOMES:-

- Understanding about complex number and complex valued function will enable them to deal with function of multi variable.
- Students will able to transform the region /object of one plane onto another plane easily.
- Cauchy theorem will help them to find the integration of function on the region where function is analytic and where it is not Analytic.
- Cauchy integral formula with help students to find the value of function at inside point of the region.
- Students will able to expand function in series of positive and negative power of variable in a given region.

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COURSE CODE: 6SMMA105

Differential Equation-I

COURSE OBJECTIVE:-

- This course helps the students to study elementary concepts.
- To introduce the concept of simultaneous differential equations.
- Understanding the concept of integration in series.
- To understand the Existence and Uniqueness theorem.

Syllabus:

UNIT – I Elementary Concepts: Linear equations of second order, Transformation of the equation to the normal form, Transformation of the equation by changing the independent variable, Method of variation of parameters.

UNIT – II Ordinary simultaneous differential equations, Differential equations in different form, Total differential equation.

UNIT – III Integration in series : Roots of indicial equation equal, Roots of indicial equation unequal and differing by a quantity not an integer, Roots of indicial equation equal differing by an integer making coefficient of y-infinity.

UNIT – IV Roots of indicial equation differing by an integer ; making a coefficient of y indeterminate, Some cases where the method fails, The particular integral, Method of differentiation.

UNIT – V Picard's iteration method, The Lipschitz condition, Existence theorem, Uniqueness theorem, Existence and Uniqueness theorem (The general case).

COURSE OUTCOMES:-

- The student will be able to define the elementary concept of differential equations.
- The student will be able to define and work with the concept of simultaneous differential equations.
- The student will be able to define and work with the concept of integration in series.
- The student will be able to apply the iteration method.

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COURSE CODE: 6SMMA201

Advance Abstract Algebra -II

COURSE OBJECTIVES:-

- The focus of the course will be the study of modules over a ring.
- In particular to study in details the Noetherian and Artinian modules and rings.
- This course helps to study the Linear transformations, Algebra of Linear transformations & Linear operators.
- In particular to study in details the Nilpotent transformations, Jordan blocks & forms.
- This course helps to study the fundamental structure theorem of modules over PID and also helps to gain knowledge about its application to finitely generated abelian group

Syllabus:

UNIT – I Introduction to modules- Examples, sub modules, quotient modules. Module homomorphism, isomorphism.

UNIT – II Finite generate modules, Fundamental structure theorem for finitely generated moduls over a principal ideal domain its application of finitely generated abelian group. cyclic modules.

UNIT – III Simple modules, semi simple modules, free modules, Schurs lemma. Neotherian & artinian modules and ring

UNIT – IV Schroeder- Bernstion Theorem, Hillebert basic Theorem, Wedderburn - Artin Theorem,

UNIT – V Uniform modules, primary modules, Noether - Laskar Theorem. Fundamental structure theorem of module over a principle ideal domain and its application to finitely generated abelian groups.

COURSE OUTCOMES:-

- The student will be able to define the concepts of module over a ring and will be able to readily give examples of this kinds of algebraic structures.
- The student will be able to define and work with the concepts of Noetherian and Artinian modules and rings.
- The student will be able to define the concept of Linear transformations, Algebra of Linear transformations & Linear operators, Nilpotent transformations, Jordan blocks & forms.
- The student will be able to give detail proof and work with the concepts of Schur's Lemma.
- The student will be able to apply the basic concepts of modules, including uniform and primary modules.

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COURSE CODE: 6SMMA202

Real Analysis-II

COURSE OBJECTIVES:-

- To make familiarize the student with Riemann-Stieltjes integral and their application.
- To make the student acquire sound knowledge of techniques in solving problems on function of several variable and Jacobian

Syllabus:

UNIT – I Definition of Riemann-Stieltses Integral & theorems, The Rs-Integral as limit of sums, Some classes of Rs-Integrable function, Algebra of Rs-Integrable function, The Interval of integration, The Rs-Integrability of composite function.

UNIT – II Relation between R- Integral & Rs-Integral, Integration of vector valued function, some more Theorems on integration.

UNIT – III Continuity of function of two variables, Partial Derivatives, Differentiability of two variables, Differentiability of composite function.

UNIT – IV Differentiation, Differentiation of vector-valued function, Differentiation in Rn, The implicit function Theorem.

UNIT - V Definition of Jacobians', Case of function of function, Jacobian of implicit functions, Necessary and Sufficient condition for a Jacobian to Vanish Identically.

COURSE OUTCOMES:-

- Understanding ideas and concept of Riemann – Stieltjes integral and facility in solving standard examples.
- Fluency in solving standard methods, including the ability to find an appropriate method for a given function of several variables.
- Understanding the ideas of Jacobian and facility in solving standard examples.

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COURSE CODE: 6SMMA203

Topology-II

COURSE OBJECTIVES:-

The aim of this course is to provide students

- An introduction to theory of metric and topological spaces with emphasis on those topics that are important to higher mathematics.
- Basic notions of metric and topological spaces.
- Information about the properties of continuous mappings and convergence in topological spaces.
- The broader information of some selected types of topological spaces (compact, product, connected spaces) and countability, separation axioms including some basic theorems on topological spaces.
- Information about product invariance of certain separation and countability axioms.

Syllabus:

UNIT - I Separation Axioms: Regular and T3 spaces, normal and T4 spaces, Urysohn's Lemma, Tietze's, Extension theorem, completely regular and Tychonoff spaces, completely normal and T5 spaces.

UNIT – II Count ability Axioms: First and second axioms of countability, Lindelof spaces , Separable spaces , Coutably compact spaces, Limit point compact spaces.

UNIT - III Convergence in Topology: Sequences and subsequences, convergence in topology, sequential compactness, local compactness, one point compactification, Stone-Cech compactification.

UNIT – IV Metric Spaces and Metrizability: Separation and countability axioms in metric spaces, convergence in metric spaces, complete metric spaces.

UNIT – V Product Spaces: Arbitrary product spaces, product invariance of certain separation and countability axioms, Tychonoff's Theorem, product invariance of connectedness.

COURSE OUTCOMES:-

Upon successful completion of the program the students will be aware of:-

- The definitions of standard terms in topology.
- How to read and write proofs in topology with a variety of examples and counter examples.
- Some important concepts like continuity, compactness, connectedness, projection mapping etc
- Countability, separation axioms and convergence in topological spaces.
- Using new ideas in mathematics and also help them in communicating the subject with other subjects.

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COURSE CODE: 6SMMA204

Complex Analysis-II

COURSE OBJECTIVES:

- To introduce the concept of zero is and singularities of a complex valued function.
- To introduce residues theorem as well as some definite integral round the unit circle.
- To introduce the concept of integral of rational function on the semi circular region.
- To introduce the concept of fixed point and bilinear transformation and their special from.
- To introduce the concept of analytic function and multiple valued function.

Syllabus:

UNIT – I Fundamental theorem of integral calculus for complex functions, uniqueness theorem, The zero of an analytic function, Singularities of an analytic function.

UNIT – II Residues, Cauchy's residue theorem, Evaluation of real definite integrals by contour integration, Integration round the unit circle.

UNIT – III Evaluation of the integral . Evaluation of the integrals of the form , , m>0, where P(x),Q(x) are polynomials,deg Q(x) > deg P(x) Q(x)=0 has no real roots.

UNIT – IV Fixed points or Invariant points of a Bilinear transformation, Normal form of a Bilinear transformation, Elliptic, Hyperbolic and parabolic transformations, some special Bilinear transformations.

UNIT – V Analytic, Holomorphic and Regular function, Polar form of Cauchy-Riemann Equations, Derivative of w = f(z) in polar form, orthogonal System, Multiple Valued function.

COURSE OUTCOMES:-

- Understanding the concept of singularities will help student to find integral of complex valued function on some simple connected region and multi connected region.
- Students will able to solve definite integral easily which is quite difficult by analytical method.
- Understanding fixed point would help students to learn more about those type of function which posses fixed point.
- Students will learn more about everywhere differentiable function and they will learn how it helps them to decide analyticity of function.

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COURSE CODE: 6SMMA205

Differential Equations-II

COURSE OBJECTIVE:-

- This course helps the students to study Linear and Non linear differential equations.
- To introduce the concept of boundedness of solutions.
- Understanding the concept of Legendre polynomials.
- To understand the Legendre's function of the second kind.

Syllabus:

UNIT – I Linear and Non-linear differential equation, Independence of constants of integration, some theorems on second order linear differential equations, Linear dependence and independence of solutions of an equations.

UNIT – II Boundedness of solutions, L^2- Boundedness, Oscillatory equations, Number of zeros, The adjoint equation, Lagrange's identity, Greens formula, Lagrange's identity in case of second order, Self-adjoing.

UNIT – III Legendre polynomials, Solution of Legendre's equation, Definition of $P_n(x)$ and $Q_n(x)$, Orthogonality, Recurrence formulae, Christoffel's summation formula.

UNIT – IV Rodrigue's formula, Even and Odd functions, Expansion of x^n in Legendre's polynomials, General results.

UNIT – V Legendre's function of the second kind, Neumann's Integral, Recurrence formulae for $Q_n(x)$, Relation between $P_n(x)$ and $Q_n(x)$, Christoffel's second summation formula.

COURSE OUTCOMES:-

- The student will be able to define the elementary concept of Linear and non linear differential equations.
- The student will be able to define and work with the concept of Boundedness of solutions and Langrange's identity.
- The student will be able to define and work with the concept of Legendre's polynomial.
- The student will be able to apply the Neumann's integral and Christoffel's summation formula.

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COURSE CODE: 6SMMA301

Functional Analysis-I

COURSE OBJECTIVES:-

- Understand the Normed linear spaces and Banach spaces.
- Be familiar with the sub space and Quotient space of Banach Space.
- Understand compactness, Equivalent norms Hahn Banach theorem.
- Understand the concept of Natural imbedding theorem and Riesz lemma.
- Get exposed to the conjugate space and the conjugate of an operator.

Syllabus:

UNIT – I Normed linear space, Banach spaces examples and theorems ,Holders inequality, Minkowshki's inequality, Cauchy's inequality.

UNIT – II Completeness of c^n , the space l_p^n , completeness of l_p^n ,the space l_p ,Riesz – Fisher theorem.

UNIT – III Sub space and Quotient spaces of Banach space , Narm of Bounded (continuous) linear transformation , basic properties of finite dimensional normed linear space.

UNIT – IV Compactness , Equivalent norms ,Riesz –lemma ,Convexity theorem ,the natural imbedding of N in N** ,Reflexivility .

UNIT – V The conjugate space of l_p ,weak convergence , the conjugate of an operator , dual spaces with examples , uniform boundedness theorem .

COURSE OUTCOMES:-

- To learn to recognize the fundamental properties of normed linear space and to learn classify the standard examples.
- To understand the Banach space.
- Demonstrate accurate and efficient use of compactness.
- To explain the conjugate space and learn to use properly the specific techniques for conjugate of an operators over the Banach space.

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COURSE CODE: 6SMMA302

Integral Transform-I

COURSE OBJECTIVES:-

- To expose students to learn Laplace and Fourier transform.
- To equip students with the methods of finding Laplace transform and Fourier transform of different functions.
- To make students familiar with the methods of solving IVP and BVP using laplace and fourier transform.
- To make students informative to complex fourier transform.

Syllabus:

UNIT – I Definition and Properties .Sufficient Conditions for the existence of Laplace Transform. Laplace Transform of some elementary functions. Laplace Transform of the derivatives. Inverse of Laplace Transform. Initial and final theorems..Learch's theorem .Heaviside's expansion theorem. Convolution theorem.

UNIT- II Some of ordinary Differential Equations with Constant Coefficients. Solution of ordinary differential equation with variable coefficients. Solution of Simultaneous ordinary differential equation. Solution of Partial differential equations. Application to electrical equations .Application to mechanics. Application of Laplace transform to integral equations.

UNIT – III Application of Laplace transform in initial Boundary value problems. Heat conduction equation.Wave equation.Laplace equation Application to Beams.

UNIT - IV Dirichlet's condition.Fourierseries.Fourierintegralformula,Fouriertransform or complex Fourier transform. Inversion theorem for complex Fourier transform. Fourier Sine and Cosine Transform.
Change of Scale Property, Shifting Property .Modulation theorem. Multiple Fourier transform. Convolution. The Convolution or falting theorem for Fourier transform. Parseval's identity for Fourier transform.

UNIT – V Finite Fourier sine transform. Inversion formula for sine transform. Finite Fourier cosine transform. Inversion formula for cosine transform. Multiple finite Fourier transform theorems on operational properties of finite sine and cosine transform. Combined properties of finite Fourier sine and cosine transform .

COURSE OUTCOMES:-

Upon successful completion of this course, students will be able

- To calculate the Laplace transform and Inverse Laplace Transform of standard functions.
- To select and use the appropriate shift theorems in finding laplace and inverse laplace transform.
- To combine the necessary Laplace transform techniques to solve second order differential equations.
- To find the complex Fourier transform of some functions .
- To find the Fourier transform of some elementary and standard functions with properties of finite Fourier sine and cosine transform.

Chairperson (Board of Studies)	**Dean (Academic Council)**	**(Registrar) Seal**

COURSE CODE: 6SMMA303

Special Function-I

COURSE OBJECTIVE:-

- To study the Gamma function and related functions.
- To introduce Hypergeometric differential equations and generalized Hypergeometric differential equation.
- This course helps to solve Hermite's differential equation**.**
- To introduce the Laguerre Polynomials
- To introduce the Jacobi Polynomials.

Syllabus:

UNIT – I	Special Functions, Infinite series , ortho gonal Polynomials, eulerian definition Weistrass Defination, Eulerian Product гz Evaluation of г(i) and F'(1/2)/ г(1/2) Equivalence of Weierstrass and Euler Defination , Factorial Function Gauss' Multiplication Formula .
UNIT – II	Hypergeometric Function , Integral Represention of f(a,b ; c,z) Relation of contiguity , Hypergeometric differential equation , transformation of f(a,b ; c,z)
UNIT – III	Introduction of generalized Hypergeometric Function , Differential Equation Satisfied by pfq , saalsehutz Theorem , whipples Theorem , Dixon's Theorems
UNIT – IV	Integrals involving Generalized hypergeometric Functions, Kummers Theorems, Ramanujans Theorems.
UNIT – V	Generating Function for Jn(z) , Alternative Form of Generating Function Recurrence relation for Jn(z) , Bessel's integral , Spherical Bessel Functions , Neumann Polynomials & series .

COURSE OUTCOMES:

- The student will be able to solve the Gamma function and related functions.
- The student will be able to solve the Hypergeometric Function.
- The student will be able to solve the Hermit Polynomials.
- The student will be able to solve the Laguerre Polynomials.
- The student will be able to study the Jacobi Polynomials .

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(Board of Studies)	**(Academic Council)**	**Seal**

COURSE CODE: 6SMMA304

Advance Discrete Mathematics (DSE-I)

COURSE OBJECTIVE:-

The aim of the course is to develop students

- a solid understanding of algebraic structure and also the advanced concepts covered in the course.
- to use techniques from algebra, analysis and probability to solve problems in discrete mathematics.
- A solid understanding about semigroups, monoids, lattices and trees.
- a good grasp of the applications of this subject in other areas of mathematics and to real world problems.

Syllabus:

UNIT – I Algebraic Structures : Introduction , Algebraic Systems : Examples and General Properties : Definition and Examples , Some Simple Algebraic Systems and General Properties , Homomorphism and Isomorphism congruence relation ,.

UNIT – II Semigroup & Monoids : Defination & Examples , Homomorphism of semigroups and Monoids

UNIT – III Lattices : Lattices as Partially ordered Sets : Defination and Examples , Principale of duality , some Properties of Lattices , Lattices as Algebraic Systems , Sublatttices , Direct Product and Homomorphism.

UNIT – IV Some special Lattices e.g. complete , Complemented and Distributive Lattices , Boolean Algebra : definition and Examples , Subalgebra , Direct product and Homomorphism , Join irreducible , atoms and antiatoms.

UNIT – V Trees : Trees and its properties, minimally connected graphs pendant vertices in a tree, distance and centers in a tree , rooted and binary tree Levels in a binary tree , height of a tree , Spanning tress , rank and Nullity.

COURSE OUTCOME:-

Upon successful completion of this course, the students will be able to:

- Understand the basic principles of sets and operations in sets.
- Demonstrate different traversal methods for trees and graphs.
- Write model problems in mathematical science using trees and graphs.
- Evaluate Boolean functions and simply expressions using the properties of Boolean algebra.

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COURSE CODE: 6SMMA305

Partial Differential Equations (DSE-I)

COURSE OBJECTIVES:-

- Learn to solve Partial Differential Equation of Second Order.
- To make students familiar with Green's Function and Harmonic Function.
- Understand the application of Partial Differential Equations.
- Learn to solve fundamental solution of Laplace equation.

Syllabus:

UNIT – I Partial Differential Equation of Second Order:
Introduction, Classification of Linear partial differential equations of second order, canonical forms, The solution of linear Hyperbolic equations, Riemann method of solution of general hyperbolic equation of the second order.

UNIT – II Green's Function and Harmonic Function:
Introduction, Green's function for Laplace equations, The method of images, The Eigen function method, Green's function for the Wave equation- Helmholtz theorem, Green's function for diffusion equation, Properties of harmonic functions, The spherical mean, Mean value theorem for Harmonic function.

UNIT – III Application of Partial Differential Equations:
Introduction, Practical problems involving PDE, One dimensional wave equation, Two dimensional wave equation, Heat equation, One and two dimensional Heat equation, Diffusion equation, Method of separation of variable or product method.

UNIT – IV Solution of Laplace's equation in polar coordinates, Vibration of a circular membrance, Laplace's equation in terms of spherical coordinates, Laplace's equation in terms of sylindrical co-ordinates.

UNIT – V Fundamental solution of Laplace equation, Poisson's equation, Regularity, Local estimates for harmonic functions, Maximum-Minimum principle, Green's identities, Applications of Green's identities, Dirichlet condition, Representation formula, Harnack's inequalities, energy methods.

COURSE OUTCOMES:-

After completion the students will be able to:

- Solve Partial Differential Equation of Second Order.
- Solve some problems of Green's Function and Harmonic Function.
- Understand the application of Partial Differential Equations
- Find the solutions of Laplace equation and Poisson's equation.

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COURSE CODE: 6SMMA306

Numerical Analysis (DSE-I)

COURSE OBJECTIVES:-

- This course aims to provide the information about systems of linear equations.
- This course helps to study the different methods of Interpolation, Differentiation and Integration.
- To understand the concept of approximation of functions.
- To introduce the concept of Ordinary and Partial differential equations.
- This course helps to gain skill in problem solving and critical thinking.

Syllabus:

UNIT - I Systems of Linear equations and Algebraic Eigen value Problems **Direct Method**: Gauss elimination method, Error analysis, **Iterative methods**: Gauss Jacobi and Gauss-Seidel method, Convergence considerations, Eigen value problem: Power method.

UNIT - II Interpolation Differentiation and Integration **Interpolation**: Lagrange's and Newton's interpolation, Errors in interpolation, Optimal points for interpolation, Numerical differentiation by finite differences, **Numerical integration**: Trapezoidal, Simpson's and Gaussian quadratures, Error in quadratures.

UNIT - III Approximation of functions Norms of functions, **Best approximations**: Least squres polynomial approximation, Approximation with Chebyshev polynomials, Piecewise linear and cubic spline approximation .

UNIT - IV Ordinary Differential Equations **Single step methods**: Euler's method, Taylor series method, Runge-Kutta method of fourth order, **Multistep methods**: Adam's Bashforth and Milne's Thomson method, Stability considerations, **Linear two point BVPs**: Finite difference method.

UNIT - V Partial Differential Equations **Elliptic Equations:** Five point finite difference formula in rectangular region, Truncation error; **One dimensional parabolic equation**: Explicit and Crank – Nicholson schemes; Stability of the above schemes, **One dimensional hyperbolic equation:** explicit scheme.

COURSE OUTCOMES:-

- The student will be able to solve the system of linear equations and algebraic eigen value problems.
- Understanding the ideas of solving interpolation, differentiation and integration.
- Fluency in solving approximation of functios.
- The student will be able to solve ordinary differential equation by various methods.
- The student will be able to solve elliptic,one dimensional parabola and hyperbola equations.

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COURSE CODE: 6SMMA307

Mathematical Statistics (DSE-II)

COURSE OBJECTIVES:-

- To tell sampling distributions and estimation theory.
- To introduce the concept of testing of hypothesis.
- To introduce the concept of correlation and regression.
- In particular to study the design of experiments.
- This course helps to study multivariate analysis.

Syllabus:

UNIT - I Sampling Distributions and Estimation Theory Sampling distributions, Characteristics of good estimators, Method of moments, Maximum likelihood estimation, Interval estimates for mean, Variance and Proportions.

UNIT- II Testing of Hypothesis Type I and Type II errors, Tests based on normal, t, χ^2 and F distributions for testing of mean, variance and proportions, Tests for independence of attributes and goodness of fit.

UNIT - III Correlation and Regression Method of least squares, Linear regression, Normal regression analysis, Normal correlation analysis, Partial and multiple correlation, Multiple linear regression.

UNIT - IV Design of Experiments Analysis of variance, One way and two way classifications, Completely randomized design, Randomized block design, Latin square design.

UNIT - V Multivariate Analysis Covariance matrix, Correlation matrix, Normal density function, Principal components, Sample variation by principal components, Principal components by graphing.

COURSE OUTCOMES:-

- The student will be able to solve the Mean, Variance and Proportions.
- The student will be able to find Type I and Type II errors by various distributions methods.
- The student will be able to apply method of least squares.
- The student will be able to study the analysis of variance.
- The student will be able to study covariance matrix, correlation matrix and principal components by graphing.

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COURSE CODE: 6SMMA308

Number Theory (DSE-II)

COURSE OBJECTIVES:-

- To introduce the concept Binomial theorem.
- To introduce the concept of Congruences and Techniques of Numerical calculations.
- To introduce the concept of Publickey cryptography.
- In particular to study the Combinational number theory.
- This course helps to study Farey sequences and functions.

Syllabus:

UNIT – I Divisibility Introduction, Divisibility, Primes, The Binomial theorem.

UNIT - II Congruences, Solutions of Congruences, The Chinese remainder theorem, Techniques of numerical calculations.

UNIT- III Application of Congruence and Quadratic Reciprocity Publickey cryptography, Prime power moduli, Prime modulus, Primitive roots and Power residues, Quadratic residues, The Gaussian reciprocity law.

UNIT - IV Functions of Number Theory Greatest integer function, Arithmetic functions, Mobius inversion formula, Recurrence functions, Combinational number theory.

UNIT - V Diophantine Equations and Farey fractions The equations $ax + by = c$ Pythagorean triangle, Shortest example, Farey sequences, Rational approximations.

COURSE OUTCOMES:-

- The student will be able to solve Divisibility.
- The student will be able to find solutions of congruences.
- The student will be able to apply method of Congruence and Quadratic Reciprocity.
- The student will be able to study the analysis of Functions of Number Theory.
- The student will be able to study Diophantine Equations and Farey fractions.

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COURSE CODE: 6SMMA309

Differential Geometry (DSE-II)

COURSE OBJECTIVES:-

- To introduce the theory of space curves.
- To introduce the concept of surface in R^3.
- To introduce the concept of Envelopes.
- To introduce the concept of Asymptotic lines and the fundamental equations of surface theory.
- To introduce the concept of Geodesics theorem and mappings.

Syllabus:

UNIT – I Theory of space curves, arc length, tangent and normal's, Curvature and torsion of curve given as the intersection of two surfaces, Involute and Evolute .

UNIT – II The first and second fundamental form of a surface, Weingarton equation, Orthogonal trajectories, Mensuier theorem, Gaussian curvature, Euler's theorem, Dupin's theorem, Rodrigue's theorem, Dupin's indicatrix.

UNIT – III Envelopes, Edge of regression, Ruled surface, Developable surface, Monge's theorem, Conjugate directions.

UNIT – IV Asymptotic lines, The fundamental equations of surface theory, Gauss's formulae, Gauss characteristics equations, Mainardi Codazzi equations, Weingarton equations, Bonnet's theorem on parallel surface.

UNIT – V Geodesics, Clairaut's theorem, Gauss Bonnet theorem, Conformal mapping and Geodesic mappings, Tissot's theorem, Dini's theorem.

COURSE OUTCOMES:-

- The student will be able to solve the theory of space curves.
- The student will be able to solve the fundamental form of surface.
- Fluency in solving Envelopes and regression.
- The student will be able to solve the fundamental equations of surface theory.
- The student will be able to apply Geodesics theorem .

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COURSE CODE: 6SMMA401

Functional Analysis-I

COURSE OBJECTIVES:-

- Understand the Inner product space and Hilbert space.
- Understand the Orthogonality .
- Be familiar with the concept of Riesz representation theorem for continuous linear functional on Hilbert space .
- Get exposed to the adjoint, self adjoint, Normal and Unitary operators.
- Understand Finite dimensional Spectral theory.

Syllabsu:

UNIT - I Open mapping theorem ,Closed graph theorem , Hahn –Banach theorem for linear spaces .

UNIT - II Inner product spaces , Hilbert spaces , some properties of Hilbert spaces ,Schwarz inequality.

UNIT- III Orthogal complements , projection theorem , Ortthonarmel sets , Bessel's inequality ,complete Orthonarmal set .

UNIT- IV The conjugate space H* ,Riesz representation theorem for continuous linear functional on a Hilbert space.

UNIT- V The Adjoint of an Oprtator , self adjoint operator ,Normal and operators.

COURSE OUTCOMES:-

To be able to understand the method of application of Open mapping theorem ,Closed gra theorem , Hahn –Banach theorem for linear spaces , Inner product spaces, Orthogo complements & Adjoint of an Oprtator

- To understand Hilbert space and the fundamental properties of it.
- To learn the application of Bessel's and Schwarz inequality.
- To explain the conjugate space of Hilbert space.
- To learn to use properly the specific techniques for operators over Hilbert space.
- To learn to use finite dimensional spectral theory .

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COURSE CODE: 6SMMA402

Advance Graph Theory (DSE-III)

COURSE OBJECTIVE:-

The aim of the course is to develop students:

- A solid understanding of the perfect graph and other class of perfect graphs.
- To understand Ramsey theory.
- A solid understanding about Extremal graph.
- A solid understanding about Connectedness in diagraph.
- To learn properties of Tournaments.

UNIT – I **Perfect Graphs**

The perfect graph theorem, Chordal graphs, Other class of perfect graphs, Imperfect graphs, The strong perfect graph conjecture.

UNIT – II **Ramsey Theory**

Ramsey's theorem, Ramsey number, Graph Ramsey theory, Sperner's lemma and Bandwidth.

UNIT – III **Extremal Graphs**

Encodings of graphs, Branchings and gossip, List coloring and choosability, Partitions using Paths and Cycles.

UNIT – IV **Connectedness in Digraphs**

Digraphs, Connected and disconnected graphs, Strong digraphs, Digraphs and matrices.

UNIT – V **Tournaments**

Properties of tournaments, Hamiltonian tournaments, Score sequences.

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

- Apply the perfect graph theorem.
- Apply Ramsey theory.
- Encode the graphs.
- Understand the connected and disconnected graphs.
- Understand the Hamiltonian tournaments.

TEXT BOOK:

- M. Bezhad, G. Chartrand, L. Lesneik Foster, "Graphs and Digraphs", Wadsworth International Groups, 1995
- Douglas B. Waste, "Introduction to Graph Theory", Prentice Hall of India, 2002.

REFERENCES BOOK:

- Martin Charles Golumbic, "Algorithmic Graph Theory and Perfect Graphs", Academic Press, 1980.
- Bela Bollabas, "Extremal Graph Theory", Dover Publications, 2004.
- Jorgan Bang-Jensen and Gregory Gutin, "Digraphs-Theory, Algorithms and Applications", Springer and Verlag London, 2001.

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COURSE CODE: 6SMMA403

Integral Transform-II (DSE-III)

COURSE OBJECTIVES:-

- To apply the Fourier transform method for solving IVP and BVP.
- To learn Hankel transform and its properties.
- To apply Hankel transform in IVP and BVP.
- To understand the basic concept of Mellin transform and its properties

Syllabus:

UNIT – I Application of Fourier transform in initial and boundary value problems: Application of infinite Fourier transform. Choice of infinite sine or cosine transforms. Applications of finite Fourier transform. Finite Fourier transform of partial derivatives.

UNIT – II Definition of Hankel transform. Inversion formula for the Hankel transforms. Some important results for Bessel functions. Linearity property. Hankel transform of the Derivatives of a Function.

UNIT – III Hankel transform of(d^2 f)/〖dx〗^2 +1/x df/dx-n^2/x^(2) f. Parseval’s Theorem .Definition of finite Hankel transform. Another form ofHankel transform.Hankel transform ofdf/dx.

UNIT – IV Hankel transform ofof(d^2 f)/〖dx〗^2 +1/x df/dx,where p is the root of the equationJ_n (ap) =0.Applications of HankelTransform in initial and boundary value problems.

UNIT – V Definition of Mellin transforms. The Mellin Inversion theorem. Linearity property. Some elementary properties &Mellin transform.Mellin transform of derivatives. Mellin transform of integrals. Convolution (or falting).

COURSE OUTCOMES:-

Upon successful completion of course the students will be able :

- To find the Hankel transform of some functions
- To apply the Fourier transform methods for solving functions.
- To demonstrate accurate and efficient use of Hankel transform techniques.
- To understand the application of Hankel transform
- To get exposed how to use the properties of Mellin transform in solving various functions.

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COURSE CODE: 6SMMA404

Special Function-II (DSE-III)

COURSE OBJECTIVE:-

Explain the method of application of Hermit Polynomials solution of Hermites different equation , Bateman's Generating Relation , Laguerre Polynomials Solution of Laguer differentials Equation & Jacobi Polynomials

Syllabus:

UNIT – I Introduction of Hermit Polynomials solution of Hermites differential equation , Generating Function of Hermites Polynomials Rodrigues Formula for Hn(x), Recurrence relations for Hn(x)

UNIT – II Bateman's Generating Relation Integral Representation of Hermite Polynomial ortnagonal Properties of Hn(x) , Expansions of Polynomials .

UNIT – III Introduction of Laguerre Polynomials Solution of Laguerres differentials , Equation , Generating Function of Laguerre Polynomilas , Rodrigues Formula, Recurrence Releations of Rodrigues Formula .

UNIT – IV Generlised Laguerre Polynomial ,Recurrence Releation .

UNIT – V Introduction of Jacobi Polynomials, Generating Functions of Jacobi Functions Rodrigues Formula , Orthogonal Properties Recurrence Releation .

COURSE OUTCOMES:-

To be able to understand the method of application of Hermit Polynomials solution Hermites differential equation , Bateman's Generating Relation , Laguerre Polynomi Solution of Laguerres differentials Equation & Jacobi Polynomials.

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COURSE CODE: 6SMMA405

Operation Research (DSE-IV)

COURSE OBJECTIVE:-

The aim of this course is to introduce students:-

- To establish theories and algorithms to model and solve mathematical optimization problems that translate to real life decisions making problems.
- To get exposed to the concept of linear programming problems and algorithm of linear programming problems.
- With some key topics such as, goal programming, transportation and assignment problems, network analysis and dynamic programming that will enable students to analyze the real life problems to reach at optimality.

Syllabus:

UNIT – I Operation research and its Scope , Necessity of Operation Research in Industry , Linear Programming – Simplex Method, theory of the Simplex Method , Duality and Sensitivity Analysis .

UNIT – II Algorithms for Linear Programming- Dual Simplex Method , Parametric Linear Programming , Upper – Bound Technique , Interior Point Algorithm, Linear Goal Programming.

UNIT – III Transportation and Assignment Problems.

UNIT – IV Networks Analysis – Shortest Path Problem , Minimum Spanning Tree Problem , Maximum Flow Problem , Minimum cost Flow Problem , Network Simplex Method , Project Planning.

UNIT – V Dynamic Programming- Deterministic and Probabilistic Dynamic Programming.

COURSE OUTCOMES:-

On completion of this course students will be able to:-

- Define and formulate linear programming problems and appreciate their limitations
- Solve LPP using appropriate techniques and optimization solvers, interpret the results obtained and translate solutions into directives for s.
- Conduct and interpret post-optimal and sensitivity analysis and explain their primal-dual relationships.
- Develop mathematical skills to analyze and solve integer programming, parametric linear programming and network models arising from wide range of applications.
- find maximum (of profit or yield) or minimum (of loss or cost) in real world objective.

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COURSE CODE: 6SMMA406

Metric Spaces & Fixed Point Theory (DSE-IV)

COURSE OBJECTIVES:-

- To introduce the concept of metric contraction principles.
- To introduce hyperconvex spaces and normal structure in metric spaces.
- To introduce continuous mapping in Banach spaces.
- This course helps to provide the basic information of metric fixed point theory.
- To introduce the Banach space ultra powers.

Syllabus:

UNIT - I Metric Contraction Priciples Banach contraction Principle, Further extension of Banach's principle, Caristis, Ekeland principle, Equivalence of the Caristis, Ekeland principle, Set values contraction,Generalized contractions.

UNIT - II Hyperconvex spaces and Normal structures in metric spaces Hyperconvexity, Properties of Hyperconvex spaces, a fixed point theorem, Approximate fixed poits. Normal structures in metric spaces: a Fixed point theorem, Structure of the fixed point set, Fixed point set structure, Separable case.

UNIT – III Continuous mapping in Banach spaces Brouwer's theorem, Further comments on Brouwer's theorem, Schauder's theorem, Stability of Schauder's theorem, Banach algebra's: Stone Weierstrass theorem, Leray, Schauder degree, Condensing mappings, Continuous mappings in hyperconvex spaces.

UNIT - IV Meric fixed point theory Contraction mappings, Basic theorem for non expansive mapping, Structure of the fixed point set, Asymptotically regular mapping, Set valued m,appings.

UNIT - V Banach space ultra powers Some fixed point theorem, Asymptotically non expansive mappings, the Dami closedness principle.

COURSE OUTCOMES:-

- The student will be able to understand the concept of Banach contraction principle.
- Understanding the concept of hyperconvexity and normal structure in metric spaces.
- The student will be able to apply Brouwer's theorem and Schauder's theorem.
- The student will be able to apply the basic concepts contraction mappings.
- The student will be able to apply the Demi closedness principle.

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COURSE CODE: 6SMMA407

Measure & Integration Theory (DSE-IV)

COURSE OBJECTIVES:-

- To gain understanding of the abstract Measure Theory and definition and main properties.
- To construct Lebesgue Measure on the real line and in n- dimensional Euclidean space.
- To explain the basic advanced directions of the theory.

Syllabus:

UNIT - I	Measure of set, Lebesgue outer measure (Caratheodory), measurable sets, Algebra of measurable set, Measures of locally compact, Regularity, Housdroff space .
UNIT- II	Measure space, measurable space , Lebesgue measure ,algebras, monotone classes.
UNIT- III	Borel sets and their measurability, Measureable functions, Algebras of measurable functions.
UNIT- IV	Continuous function functions, Simple function, The structure of measurable functions , Lusin theorem.Sequence of mesearable function, Convergence in measure,.
UNIT - V	Riesz theorem, Lebesgues monotone convergence theorem. Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue integral.

COURSE OUTCOMES:-

- Students acquired basic knowledge of measure and integration theory .
- Analyze measurable sets and Lebesgue measure.
- Describe the Borel sets and Measureable functions.
- The student will be able to describe the structure of measurable functions.
- The student will be able to apply Riesz theorem and Lebesgues monotone convergence theorem.

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