M.A./M.Sc Mathematics

Scheme and Syllabus

School of Distance Education
Andhra University, Visakhapatnam, Andhra Pradesh

M.A/M.Sc., MATHEMATICS (PREVIOUS)

Sl.No.	Paper	Name of the Paper
01	Paper – I	Algebra
02	Paper –II	Linear Algebra, Differential Equations and Models
03	Paper-III	Real Analysis
04	Paper – IV	Topology
05	Paper – V	Discrete Mathematics

M.A/M.Sc., MATHEMATICS (FINAL)

S.No.	Paper	Name of the Paper
01	Paper – I	Complex Analysis
02	Paper – II	Measure Theory & Functional Analysis
	OPTIONAL SUBJECTS	
03	Paper – I	Number Theory
04	Paper – II	Lattice Theory
05	Paper – III	Linear Programming & Game Theory
06	Paper - IV	Universal Algebra
07	Paper – V	Integral Equations
08	Paper –VI	Commutative Algebra
09	Paper – VII	Numerical Analysis & Computer Techniques

M.A/ M.Sc., MATHEMATICS

PROGRAM OBJECTIVES:

1. To provide comprehensive curriculum to groom the students into qualitative mathematicians.
2. Enable students to enhance their mathematical skills and understand the fundamental concepts of mathematics.
3. To provide qualitative education through effective teaching learning processes by introducing projects and participative learning.
4. To encourage collaborative learning and application of mathematics to real life situations.
5. To inculcate the curiosity for mathematics in students and to prepare them for future research.
6. Strengthen students competencies and confidence to succeed in competitive examinations, which include NBHM,GATE, CSIR NET, APSET and all such others.
7. Understand the nature of abstract mathematics and explore the concepts in further details.
8. Pursue research in challenging areas of mathematics.
9. Develop abstract mathematical thinking.
10. Apply the knowledge of mathematical concepts in interdisciplinary fields.
11. Model the real-world problems into mathematical equations and draw the inferences by finding appropriate solutions.

PAPER -I Algebra

Course objectives:

1. To introduce the basic concepts of group theory and study the structure of groups.
2. To introduce the concepts of conjugacy and G sets and prove cayley theorem. To introduce explicitly the properties of permutation groups
3. To determine structure of any abelian groups. To determine structure of finitenonabelian groups through Sylow theorems.
4. To introduce concepts of ring theory. To introduce different types of ideals. To apply Zorn’s lemma on the set of ideals.

5. To introduce prime elements and irreducible elements in a commutative integral domain. To study the domains UFD, PID and ED
6. To understand the concept of extensions of a field, based on the study of irreducible polynomials.
7. To understand the concept of normal extensions and separable extensions based on the study multiplicity of roots of a polynomial
8. To introduce the concept of group of automorphisms on a field. To introduce fixed fields. To prove the fundamental theorem of Galois theory.
9. To apply Galois theory and prove the fundamental theorem of algebra. To study the properties of nth cyclotomic polynomial.
10. To understand Galois theory and study its applications.

Unit – 1 :

Semi-groups and Groups: Homomorphisms: Subgroups and Cosets; Cyclicgroups and permutation groups; Normal subgroups and quotient groups; Isomorphism theorems: Automorphism; Conjugacy and G-sets.

Unit – 2 :

Cyclic decomposition in permutation groups: Alternatinggroups A; Simplicity of A,; Directproducts; Finitely generated abelian group; Invariants of Abellan group: SylowTheorems; Groups of order$p^2$and pq

Unit – 3 :

Definition and examples of rings: Subrings and characteristic of a ring; Ideals;Homomorphisms; Maximal and prime ideals: Unique Factorisation Domains; Principal Ideal Domains and Euclidean Domains: Polynomial rings over UFD's.

Unit – 4 :

Field Extensions: Irreducible polynomials and eisestin criterion; Adjunction of roots;Algebraic extensions.

PAPER II: LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS

Course Objectives

1. To introduce the essential concepts of linear transformations on finite dimensional vector spaces.
2. To understand the utilization of ordered basis to represent linear transformations by matrices.
3. To select a single linear operator on finite dimensional vector space and to take it apart to see what makes it tick.
4. To characterise the smallest subspace of a vector space which is invariant under linear operator.
5. To decompose a linear operator on a finite dimensional vector space into a direct sum of operators which are elementary.
6. Familiarize with essential concepts of real function theory that help to grasp the theory of ordinary differential equations
7. To introduce basic theorems in theory of ordinary differential equations pertaining to existence, uniqueness, continuation of solutions.
8. To understand dependence of solutions on initial conditions and parameters
9. Transform nth order differential equations in to differential systems and extend the theory to differential systems.
10. To study the qualitative behaviour of solutions of homogeneous and non homogeneous linear equations and systems

Unit- I :

Linear transformations - Eigen values - Eigen Spaces - Triangular form - Nil-potent operators - Semi-simple matrices-Jordan Canonical forms (real and complex)

Unit- II :

The general solution of the homogeneous equations; The use of known solution to find another; The homogeneous equation with constant coefficients; The method of variation of parameters.

Unit- III :

General remarks on systems; Linear systems; Homogeneous linear systems with constant coefficients; Nonlinear systems; Volterra's prey-predator equations; The method of successive approximations; Picard’s theorem.

Unit - IV :

Introduction to Laplace Transforms a few remarks on the theory; Application to differential equations; Derivatives and integrals of Laplace transforms; Convolution and Abel’s mechanical problem.

PAPER III: REAL ANALYSIS

Course Objectives

1. Describe elementary concepts on metric spaces to get the general idea that is relevant to Euclidean spaces.
2. To study the continuity and its properties of real valued functions in metric spaces.
3. Describe the derivatives of real valued functions defined on intervals or segments, and study its properties.
4. Introduce Riemann-Stieltjes integral as a generalization of Riemann integral and discuss the existence of this integral.
5. To study differentiation of integrals and further the extension of integration to vector valued functions.
6. Discuss the most important aspects of the problems that arise when limit processes are interchanged.
7. Study the approximation of continuous complex function and its generalization and an introduction of power series.
8. Study of exponential and logarithmic functions, the trigonometric functions and Fourier series and their properties.
9. Discuss linear transformations on finite-dimensional vector spaces over any field of scalars and derivative of functions of several variables.
10. Study the method of solving implicit functions. Interesting illustration of the general principle that the local behaviour of a continuously differentiable mapping near a point. Further study of derivatives of higher order and differentiation of integrals.

Unit-1:

Sequences, Series: Power Series and absolute convergence of series, Continuity, compactness and connectedness, Differentiation, Mean value Theorems.

Unit-II:

Definitions and Existence of the integral, Properties of the integral Integration and Differtation Integration of vector valued functions, Rectifiable curves

Unit-III.

Undorm convergence and Continuity, Uniform-convergence and Differentiation; integration Equkontinuous families of functions. The Stone Weistras Theorem; Deme property of a self-adjo algebra of complex continuous functions, Power Series

Unit-IV

Linear Transformations. Differentiation, Partial derivatives, The contraction principle, the Inverse function theorem. The implica function thor The Rank Therm

PAPER IV: TOPOLOGY

Course Objectives

1. To get acquaintance with concepts of sets and functions and their properties which are basic tools to study Mathematics
2. To introduce metric spaces and some elementary concepts in metric spaces
3. To study the concept of continuous functions and their properties, Euclidean and Unitary spaces
4. To understand broader concept of topology and topological spaces, as a generalization of metric spaces and study some basic results in topological spaces
5. To study the concept of compactness and compact spaces . Some important theorems in compact spaces
6. To study Separation properties of Topological spaces ,Urysohn's lemma, Tietze's extension theorem
7. To understand the concept of metrizability of a topological space ,Urysohn'simbedding theorem and one point compactification of a topological space
8. To understand the concept of connected spaces, locally connected spaces, and totally disconnected spaces and their properties
9. To Prove Weirstrass approximation theorem and Stone - Weirstrass theorems
10. To study locally compact spaces and generalise Stone - Weirstrass theorems

Unit – 1 :

Countable se1s; uncountable se1s and partially ordered sets; Metric spaces- Definition and examples; Open sets; Closed se1s; Convergence; completeness and Baire'stheorem; Continuous mappings, Spaces of continuous functions; Eclidean and Unitary spaces.

Unit – 2 : :

Topological spaces- Definition and examples; Elementary concepts in topological spaces; Open bases and open subbas□s; Compact spaces; Product spaces; Tychon offs Theorem; Compactness in metric spaces; Ascoli's Theorem.

Unit – 3 :

T_1-spaces and Hausdorff spaces; Completely regular spaces and normal spaces;Urysohn's lemma and 1he Tietze extension theorem; Connected spaces; The components of a space; Totally disconnected spaces.

Unit – 4 :

The Weierstrass approximation theorem; The Stone-Weierstreass theorem, Locallycompact Hausdroff spaces, The extended stone-Weierstrass theorems.

PAPER 5: DISCRETE MATHEMATICS

Course Objective

1. To understand The Four Colour Theorem and applications in chemistry and physics.
2. To familiarize the basic concepts of graphs and different types of graphs.
3. To learn the modelling of Konigsberg Bridge Problem and Hamilton's Game by graphs.
4. To characterize graphs which are both Eulerain and Hamiltonian.
5. To understand specific difference between modular and distributive lattices.
6. To learn the importance of diamond and pentagon lattices.

M.A. M.Sc. Previous (Mathematics)
Paper - V : Discrete Mathematics

Unit - I :

Basic ideas in graphtheory; connectivity, Structure based on Connectivity;Trees, BinaryTrees; Spanning treesand fundamentalcycles; Traversability, Euleriongraphs, Hamiltaniangraphs.

Unit - II :

Partiallyordered sets and lattices, Properties oflattices; Modular and Distributive lattice; Boolean algebras; Booleanpolynomials; Ideals and Filters; Minimalforms of Boolean Polynomials; Switching circuits.

Unit - III :

Semi - automata and Automata; Free Semi groups; Input sequences; Monoid Automaton;Composition and decomposition; Minimal Automata.

Unit - IV :

Linear codes, Hamming distance and bounds, Weight enumerator ofa code; Cyclic codes - I; Cyclic codes - II.

M.A/ M.Sc., MATHEMATICS (FINAL YEAR)

PAPER -I:MEASURE THEORY AND FUNCTIONAL ANALYSIS

Course Objectives

1. Introduce a special theory on sets, called outer measure of a set and measurable sets, which are useful to get an idea on real number system.
2. To understand measurable functions through the certain construction of measurable sets and their properties.
3. To introduce and understand the Lebesgue integral of various measurable functions and their properties.
4. The concept of Branch space through which it helps to consider the combination of algebraic and metric structures opens up the possibility of studying linear transformations of one Banach space into another with the additional property of being continuous.
5. To understand the algebraic and topological aspects of the continuous linear functionals.
6. To study elementary theory of Hilbert spaces and their operators to provide an adequate foundation for the higher studies.
7. To understand a natural correspondence between H and its conjugate space H^*, and the adjoint of an operator on a Hilbert space.
8. To study the spectral resolution of an operator T on a Hilbert space H.

Unit – 1 :

Lebesgue Measure, Outer Measure, Measurable sets and Lebesgue measure, Lebesgue measurable functions, Littlewood’s three principles, The Lebesgue Integral of a bounded function over a set of finite measure, The general lebesgue Integral.

Unit – 2 :

Measure spaces, Measurable Functions, Integration, General Convergence Theorems, Signed Measured, The RadonNlkodym Theorem, The LP Spaces.

Unit – 3 :

Banach Spaces, The definition and some examples, Continuous linear Transformations, The Hahn-Banach Theorem, The Natural Imbedding of N in N^{**}, The Open Mapping Theorem, The Conjugate of an Operator.

Unit – 4 :

Hilbert Spaces, The Definition and some Examples, Orthogonal Complements, Orthonormal Sets, The Conjugate Space H^{*}, The Adjoint of an Operator, Self-adjoint Operators, Normal and Unitary Operators, Projections.

M.A/ M.Sc., MATHEMATICS (FINAL YEAR)

COMPLEX ANALYSIS

Course Objectives

1. To learn basic properties of power series and utilize this knowledge to construct analytic functions. To understand the relation between the Cauchy - Riemann equations and analytic functions. Study the nature and properties of Mobius transformation

2. To know about Power series expansion of analytic functions, significant properties analytic functions, zeros of analytic functions - gain knowledge pertaining to Liouville theorem, fundamental theorem of algebra, maximum modulus theorem and to know about index of a closed curve

3. To understand the three versions of Cauchy integral formula, Cauchy's theorem and StudyMorera's theorem and its significance

4. Be aware of some applications of Cauchy theorem to count zeros of an analytic function and the open mapping theorem as a property of analytic function

5. Recognize and classify singularities of an analytic function - learn about residue theorem

6. Be aware of three versions of maximum modulus theorem and also the Swartz's lemma

Unit – 1 :

The Complex Number System:

The real numbers; The field of Complex Numbers; The complex plane, Polar representation and roots of complex numbers; Lines and half planes in the complex plane; The extended plane and its spherical representation.

Elementary Properties and Examples of Analytic Functions:

Power series; Analytic functions ; Analytic functions as mappings; Mobius transformations.

Complex Integration :

Riemann - Stieltjes integral; Power series representation of analytic; functions; zeros of ananalytic function; The index of a closed curve.

Unit – 2 :

Complex Integration :

Cauchy's Theorem and Integral Formula; The homotopic version of Cauchy's Theorem andsimple connectivity; Counting zeros; the Open Mapping Theorem.

Singularities :

Classification of Singularities ; Residues; The Argument Principle.

The Maximum Modulus Theorem:

TheMaximum Modulus Theorem, The Maximum Principle, Schwartz's Lemma.

Unit – 3 :

Compactness and Convergence in the space of Analytic Functions :

The space of continuous functions; Space of analytic functions; Spaces of meromorphic

functions; The Riemann Mapping Theorem; Weierstrass Factorization Theorem; Factorization of thesine function.

Unit – 4 :

Runge's Theorem :

Runge's Theorem; Simple connectedness; Mittag- Leffler's theorem.

Analytic Continuation and Riemann Surfaces:

Schwartz Reflection Principle;Analytic Continuation along a path; MonodromyTheorem.

Harmonic Functions: Basic Properties ofharmonic functions.

M.A/ M.Sc., MATHEMATICS (FINAL YEAR)

NUMBER THEORY

Course Objectives

1. To introduce arithmetical functions and explore their role in the study of distribution of primes.
2. To study the averages of arithmetical functions and some related asymptotic formulas.
3. To introduce the foundations of congruences and study the polynomial congruences.
4. To understand the prime number theorem on distribution of primes and develop some equivalent forms.
5. To introduce the characters of a group and apply to the Dirichlet Theorem on primes in a progression.
6. To introduce the concept of Quadratic residues. To define Legendre symbol and evaluate Quadratic residue. To generalize Legendre symbol to Jacobi symbol and to study applications of Quadratic residues
7. To introduce the concept of primitive roots. To understand the study on existence of primitive roots.
8. To define Dirichlet Series and identify the plane of absolute convergence and convergence of Dirichlet series. To establish Euler products to Dirichlet series.
9. To derive some analytic properties of Dirichlet series. To develop some expressions as exponential and integral form for Dirichlet series.
10. To understand the analytic proof of prime number theorem based on the analytic properties of the particular Dirichlet series, Riemann Zeta function.

Unit – 1 :

Arithmetical Functions and Dirichlet Multiplication :

Introduction

The Mobius functions $\mu(n)$; The Euler totient function $\phi(n)$; Arelation connecting, ϕ,and μ; A product formula for ϕ,(n); The Dirichlet product of arithmetical functions. Dirichlet Inverses and the Mobius inversion formula. The Mangoldt function $\Lambda(n)$. Multiplicative functions;Multiplicative functions and Dirichlet multiplications; The inverse of a completely multiplicativefunctions. Liouville's function $\lambda(n)$; The divisor functions $\sigma_\alpha(n)$.

Averages of arithmetical functions :

Introduction :

The big oh notations; Asymptotic equality of functions. Euler's summation formula; Someelementary asymptotic formulas; The average order of d*(n)*. The average order ofdivisorfunctions $\sigma_\alpha(n)$.The average order of $\phi(n)$. An application to the distribution of lattice pointsvisible from the origin; The average order of $\mu(n)$ and of $\Lambda(n)$; The partial sums of a Dirichlet product.Applications.to $\mu(n)$ and A*(n)*.

UNIT – 2 :

Some elementary theorems on the distribution of prime numbers :

Introduction:

Chebyshev's functions $\psi(x)$ and $\theta(x)$; Relations connecting $\theta(x)$ and $\pi(x)$; Someequivalent forms of the prime number theorem. Inequalities for $\pi(x)$ and P_n.

Congruence's:

Definition and logic properties of congruences; Residue classes and Complete residuesystem; Linear Congruences; Reduced residue system and the Euler-Fermat theorem, Polynomial congruences module p; Legranges theorem; Applications of Legranges theorem;

Simultaneous linear congruences; the Chinese remainder theorem.

UNIT - 3:

Finite abelian groups and their characters

Definitions; Examples of groups and subgroups Elementary properties of groups, Constructions of subgroups; Characters of finite abelian groups; The character group. The orthogonality relations for characters. Dirichlet characters Sums involving Dirichlet Characters.

The non-vanishing of L $(1,\chi)$ for real non principle χ.

Dirichlet's theorem on primes in arithmetic progressions :

Dirichlet theorem for primes of the form *4n -1* and *4n + 1;* the plan of the proof ofDirichlet theorem; Proof of lemma 7.4; Proof of lemma 7.5; Proof of lemma 7.6; Proof of lemma7.8; Proof of lemma 7. 7; Distributions of primes Inarithmetical progressions.

(Chapter 6 and 7 of text book.)

UNIT - 4:

Quadratic residues and Quadratic reciprocity law :

Quadratic residues; Legender's symbol and its propeties; Evaluation of *(-1/P)* and*(2/P)*; Gauss lemma; The Quadratic reciprocity law; Applications of the reciprocity law.

The Jacobian symbol; Applications to Diophantine equations; Gauss sums and theQuadratic reciprocity law; The reciprocity law for Quadratic Gauss sums and another proofQuadratic reciprocity law.

M.A/ M.Sc., MATHEMATICS (FINAL YEAR)

LATTICE THEORY

Course Objective

1. To familiarize the concepts of poset, chain conditions.
2. To learn the lattice theoretic duality principle.
3. To study complements, relative complements and semi-complements of elements of a bounded lattices.
4. To learn the properties of compact elements and compactly generated lattices.
5. To study the posets as topological spaces.
6. To study equivalent conditions for a lattice to become modular and distributive.
7. To learn meet-representations of modular and distributive lattices.
8. To understand the equivalent conditions for a complete Boolean algebra to become atomic.
9. To study the properties of valuations of Boolean algebras.
10. To learn the properties of rings of sets.

SYLLABUS

Unit-I:

PARTIAL ORDERED SETS

Set Theoretical Notations, Relations: Partly Ordered Sets, Diagrams: Special Subsets of Partly Ordered Set Length, Lower, Upper Bounds: The Minimum and maximum Condition; The Jordan Dedekind Chain Condition. Dimension Functions, Algebras, Lattices, The Lattice Theoretical Dually Principle. Semi-lattices: Lattices as partially Ordered Sets, Diagrams of Lattices: Sublattices, Ideals, Bound Elements of a Lattice, Atoms and Dual Atoms; Complements Relative Complements, Semi-complements: Irreducible and Prime elements of a Lattice, The Homomorphism of a Lattice. Axiom Systems of Lattices.

Unit-II: COMPLETE LATTICES:

Complete Lattices. Complete Sublattices of a Complete Lattice: Conditionally Complete Lattices; ĀÀŬŰLattices: Compact Elements: Compactly Generated lattices, Subalgebra Lattice of an Algebra: Closure Operations: Galois Connections, Dedekind Cuts. Distributive Lattices, Infinitely Distributive and Completely Distributive Lattices: Modular Lattices: Characterization of Modular and Distributive Lattices by their sublattices, Distributive Sublattices of Modular Lattices. The Isomorphism Theorems of modular Lattices, Covering Conditions: Meet Representation in Modular and Distributive Lattices.

Unit-III BOOLEAN ALGEBRAS:

Boolean Algebras, De-Morgan Formulae, Complete Boolean Algebras: Boolean Algebras and Boolean Rings: Valuations of Boolean Algebras.

Unit-IV: IDEALS AND CONGRUENCE RELATIONS

Ideals and Dual Ideals; Ideal Chains, Ideal Lattices -Distributive Lattices and Ring of Sets Congruence Relations of an Algebra, Permutable Equivalence Relations; Congruence Relations of Lattices: Minimal Congruence Relations of some Subsets of a Distributive Lattice. The Connection between Ideals and Congruence relations of a Lattice.

M.S. / M.Sc. MATHEMATICS
FINAL YEAR – OPTIONAL PAPER
NUMERCIAL ANALYSIS & COMPUTER TECHNIQUES

Course objectives

1. demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
2. apply numerical methods to obtain approximate solutions to mathematical problems
3. Understand what the fortran programming language is an basic structure of a fortran program.
4. Compile and run a fortran program
5. Modify and write own simple programs

Unit: I

Introduction of Fortan, Constants and Variables, Arithmetic Expressions, Library Functions Arithmetic Statements, Input Output Statements, Format Specifications, Simple Computer Programs, Control Statements, The DO Statements, Functions and Subroutines

Unit : II

Numerical Differentiation, Optimum Choice of Step Length, Extrapolation Methods, Partial Differentiations, Numerical Integration,Methods Based on Interpolation, Composite Integration Methods, Romberg Integration

Unit- III

Introduction to Numerical Methods in Ordinary Differential Equations, Euler's Method, Taylor's Series Method, Runge Kutta Method, Implicit Runge Kutta Methods, Predictor – Corrector, Method, Difference Methods to Solve Boundary value Problems,Boundary Value Problems

Unit- IV

Shooting Method, Arrays and Subscripted Variables, Composite Trapezoidal Rule, CompositeSimpson's Rule, Romberg Integration, Euler's Method, Runge - Kutta Method, Predictor- Corrector Method

M.A/ M.Sc., MATHEMATICS (FINAL YEAR)

COMMUTATIVE ALGEBRA

Course Objective

1. To familiarize the essential concepts of ideals, quotient rings and homomorphisms.
2. To understand the difference between zero divisors, nilpotent elements and units.
3. To study the properties of finitely generated modulus.
4. To introduce tensor product of modulus and its exactness properties.
5. To learn the concepts of extended and contracted ideals in ring of fractions.
6. To learn the decomposition of ideals into primary ideals.
7. To learn Going-Up and Going-Down theorems concerning prime ideals in an integral extensions.
8. To study valuation rings of a given field of fractions.
9. To characterise Noetherian rings and Artin rings.
10. To study primary decomposition in Noetherian rings and to learn The Structure Theorem for Artin rings.

Unit – 1 :

Rings and ideals; ring homomorphisms; ideals and quotient rings; prime ideals and maximalideals; Nil radical and Jacobson radical; Operations on ideals; Extension and contraction;Modules and module homomorphisms; submodules and quotient modules; operations onsubmodules ;Direct sum and product; finitely generated modules; Exact sequences.

Unit – 2 :

Tensor product of modules; exactness properties of the Tensor product; Tensor product ofalgebras; Rings and modules of fractions; Local properties; extended and contracted idealsinrings of fractions.

Unit – 3 :

Primary decomposition of ideals; Integral dependence and valuations; the Going up theorem; Integrally closed integral domains; the Going-down theorem.

Unit – 4 :

Valuation rings; chain conditions; Noetherian rings; primary decomposition in Neotherian rings; Artin rings.

M.A/ M.Sc., MATHEMATICS (FINAL YEAR)

UNIVERSAL ALGEBRA

Course Objective

1. To introduce the concepts of class operators and varieties.
2. To understand the concepts of free algebras and to learn The Birkhoff's Theorem.
3. To introduce the concept of centre of algebra.
4. To learn the relation between Boolean algebras and Boolean rings.
5. To learn The Stone Duality between Boolean algebras and Boolean spaces.

Unit – 1 :

Lattices; Isomorphic lattices and sublattices; Distributive and modular lattices; Complete lattices; Equivalence relations; Algebraic lattices; Closure operations.

Unit – 2 :

Elements of Universal algebra; Definition and examples of algebras; Isomorphic algebras; subalgebras; Algebraic lattices and subuniverses; The irredundant Basis Theorem; Congruences and quotient algebras; Homomorphisms; the homomorphism theorems and isomorphism theorems.

Unit – 3 :

Direct products; Factor congruences and directly indecomposable algebras; Subdirect products; subdirectly irreducible algebras and simple algebras; Class operators and varieties; Terms; Term algebras and free algebras; Identities; Birkhoff's theorem.

Unit – 4 :

Boolean algebras; Boolean rings; Filters and ideals; Stone duality; Boolean powers;Ultra products and congruence distributive varieties.

M.A/ M.Sc., MATHEMATICS (FINAL YEAR)

INTEGRAL EQUATIONS

Course Objective

1. To study the compact linear operators, which play an important role in the theory of integral equations.
2. Banach fixed point theorem helps us to get the existence of solutions of linear algebraic equations, ordinary differential equations and integral equations.
3. To understand the Banach fixed point theorem and its applications to ordinary differential equations and integral equations.

1. Define the concepts based on integral equations. Differential equations, linear integral equations.
2. Apply and analyze with matrix algebra, degenerate kernels and also apply the integral equations in ordinary differential equations.
3. Crain the knowledge about the types of Volterra equations, convolution type kernels, Volterra integral equations.
4. Learn and analyze the concepts of fourier integral equations, integral transforms.
5. Evaluate the problems based on Eigen values and Eigen functions, learn and analyze the concepts of non-linear Fredholm equations.

Unit – 1 :

PRELIMINARY CONCEPTS

Introduction; Some Problems which give Rise to Integral Equations;Conversion of Ordinary Differential Equations into Integral Equations;Classification Linear Integral Equations; Integro-differential Equations.

Unit – 2 :

FREDHOLM EQUATIONS

Analogies with Matrix Algebra; Degenerate Kernels; Hermitian andSymmetric Kernels; The Hilbert-Schmidt Theorem; Hermitization andSymmetricization of Kernels; Solution of Integral Equations with Green's FunctionType Kernels; Miscellaneous.

(Chapter 2 of Text Book).

Unit – 3 :

VOLTERRA INTEGRAL EQUATIONS:

Types of Volterra Equations, Resolvent Kernel of Volterra Equation;Convolution TypeKernels; Some Miscellaneous Types of Volterra IntegralEquations.

INTEGRAL EQUATIONS AND TRANSFORMATIONS:

Preliminary; Fourier Integral Equations; Laplace Integral Equations; Hilbert

Transform; Finite Hilbert Transforms; Miscellaneous Integral Transforms.

Unit – 4 :

APPROXIMATE METHODS.:

General; Non-linear Volterra Equations; Non-liner Fredholm Equations;Approximate Methods of Solution for Liner Integral Equations; ApproximateEvaluation of Eigenvalues and Eigen functions.

LINEAR PROGRAMMING AND GAME THEORY

Course Objective:

This course develops the ideas underlying the Simplex method computational techniques for linear programming and game theory, having applications in management, social science, industry, warfare, economics and financial sectors, etc.

Course Learning Outcomes: This course will enable the students to learn:

i) The optimal solution for linear optimization problems subject to certain constraints.

ii) The dual to a production problem with profits to be maximized to keep total cost down.

iii) The transportation and Hungarian algorithm specially designed to solve the transportation and assignment problems, respectively.

iv) The strategies for two-person, zero-sum game are obtained by solving two dual linear programming problems.

1. Students should be able to perform the simplex method to solve Linear Programming problems.

2. Students should be able to recognize and solve simple combinatorial games.

3. Students should be able to solve matrix games.

4. Students should be able to solve network flow problems.

Unit – 1 :

Preliminaries on Vectors; Real linear Equations and Inequalities; Gonvex Cones, Convex Sets and Polytopes; Extreme Vectors and Extreme Solutions; Formulation of Linear Programming Problem and Examples; Duality and Prices; Interpretation of Duality; Price Equilibrium.

Unit – 2 :

Definition and duality theorems; Equilibrium Theorem and basic solutions, Solving of simultaneous equations and inverting a Matrix; Theory of the Simplex Method, Non-negative solutions of Linear Equations, Solving Linear inequalities.

Unit – 3 :

Flows in Net Works, Max flow-Min cut Theorem; The Assignment Problem; The Optimal assignment problem; Transhipment Problem-feasibility Theorem; Transportation Problem, Shortest route, the caterer.

Unit – 4 :

Two person-zero sum games-Definition and examples; Solutions of games-mixed strategies; Value of game and optimal strategies; Saddle points and mini-max; symmetric games. Relation between matrix games and linear programming.