DHANALAKSHMI SRINIVASAN COLLEGE
OF ARTS AND SCIENCE FOR WOMEN (AUTONOMOUS)
(AFFILIATED TO BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI)
(NATIONALLY RE-ACCREDITED WITH 'A' GRADE BY NAAC)
PERAMBALUR-621 212,TAMIL NADU
DEPARTMENT OF MATHEMATICS

M.Sc MATHEMATICS – COURSE STRUCTURE UNDER CBCS
(CANDIDATES ADMITTED FROM 2018-2019 ONWARDS)

SEM	COURSE	COURSE TITLE	COURSE CODE	INSTR PERIODS/ WEEK	CREDIT	EXAM HOURS	MARKS		TOTAL
							INTERNAL	EXTERNAL	
I	CORE COURSE – I	ABSTRACT ALGEBRA	18PMM1C1	6	5	3	25	75	100
	CORE COURSE – II	REAL ANALYSIS	18PMM1C2	6	5	3	25	75	100
	CORE COURSE –III	GRAPH THEORY	18PMM1C3	6	5	3	25	75	100
	ELECTIVE – I	DISCRETE MATHEMATICS	18PMM1E1A	6	4	3	25	75	100
		COMBINATORICS	18PMM1E1B						
	APPLICATION ORIENTED COURSE-I	ORDINARY DIFFERENTIAL EQUATIONS	18PMM1A1	6	3	3	25	75	100
	TOTAL			**30**	**22**		**125**	**375**	**500**
II	CORE COURSE – IV	LINEAR ALGEBRA	18PMM2C4	6	5	3	25	75	100
	CORE COURSE –V	COMPLEX ANALYSIS	18PMM2C5	6	5	3	25	75	100
	CORE COURSE – VI	MEASURE THEORY AND IINTEGRATION	18PMM2C6	6	5	3	25	75	100
	ELECTIVE – II	MATHEMATICAL MODELING	18PMM2E2A	6	4	3	25	75	100
		FLUID DYNAMICS	18PMM2E2B						
	APPLICATION ORIENTED COURSE-II	PARTIAL DIFFERENTIAL EQUATIONS	18PMM2A2	6	3	3	25	75	100
	TOTAL			**30**	**22**		**125**	**375**	**500**
III	CORE COURSE – VII	TOPOLOGY	18PMM3C7	6	5	3	25	75	100
	CORE COURSE – VIII	NUMERICAL ANALYSIS	18PMM3C8	6	5	3	25	75	100
	CORE COURSE – IX	FUNCTIONAL ANALYSIS	18PMM3C9	6	4	3	25	75	100
	CORE COURSE – X	CALCULUS OF VARIATIONS, TRANSFORMS AND INTEGRAL EQUATIONS	18PMM3C10	6	4	3	25	75	100
	ELECTIVE – III	STOCHASTICS PROCESSES	18PMM3E3A	6	4	3	25	75	100
		OPTIMIZATION TECHNIQUES	18PMM3E3B						
	TOTAL			**30**	**22**		**125**	**375**	**500**

IV	CORE COURSE – XI	DIFFERENTIAL GEOMETRY	18PMM4C11	6	5	3	25	75	100
	CORE COURSE – XII	CLASSICAL DYNAMICS	18PMM4C12	6	5	3	25	75	100
	CORE COURSE – XIII	MODERN PROBABILITY THEORY	18PMM4C13	6	5	3	25	75	100
	ELECTIVE – IV	AUTOMATA THEORY	18PMM4E4A	6	4	3	25	75	100
		FUZZY MATHEMATICS	18PMM4E4B						
	PROJECT WORK	PROJECT WORK	18PMM4PW	6	5	3	40	60	100
	TOTAL			**30**	**24**		**140**	**360**	**500**
	GRAND TOTAL			**120**	**90**		**515**	**1485**	**2000**

CORE COURSE - I
ABSTRACT ALGEBRA

Semester : I **Max. Marks: 75**
Course Code: 18PMM1C1 **Credit: 05**
Total Periods: 90 **Exam Hours: 03**

Objectives:

To give foundation in Algebraic structures like Groups & Rings

UNIT I (18 Periods)

Group Theory - A counting principle - Normal Subgroups and Quotient groups - Homomorphism - Cayley's theorem - Permutation groups - Another counting principle - Sylow's theorems

UNIT II (18 Periods)

Ring Theory: Homomorphisms - Ideals and quotient rings - More ideals and quotient rings - Euclidean Rings - A particular Euclidean Ring.

UNIT III (18 Periods)

Polynomial rings - Polynomials over the rational field - polynomials over commutative Rings - Inner Product spaces.

UNIT IV (18 Periods)

Fields: Extension fields - Roots of Polynomials - More about roots.

UNIT V (18 Periods)

The elements of Galois Theory - Finite fields

TEXT BOOK(S)

1. I.N. Herstein, Topics in Algebra, Second Edition, Wiley Eastern Limited.

UNIT I	- Chapter 2 Section 2.5, 2.6, 2.7, 2.9, 2.10, 2.11, 2.12
UNIT II	- Chapter 3 Section 3.3, 3.4, 3.5, 3.7, 3.8
UNIT III	- Chapter 3 & 4 Section 3.9, 3.10, 3.11, 4.4
UNIT IV	- Chapter 5 Section 5.1, 5.3, 5.5
UNIT V	- Chapter 5 & 7 Section 5.6, 7.1

BOOKS FOR REFERENCE

1. David S.Dummit and Richard M.Foote, Abstract Algebra,Third Edition,Wiley Student Edition,2015.
2. Vijay, K. Khanna, and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt Limited, 2008 (Third Edition)

CORE COURSE - II
REAL ANALYSIS

Semester : I **Max. Marks: 75**
Course Code: 18PMM1C2 **Credit: 05**
Total Periods: 90 **Exam Hours: 03**

Objectives:

To give the students a thorough knowledge of the various aspects of Real line and Metric Spaces which is imperative for any advanced learning in Pure Mathematics.

UNIT I (18 Periods)

Basic Topology: Finite, Countable and Uncountable Sets – Metric spaces – Compact sets – Perfect sets – Connected sets. Numerical Sequences and Series: Sequences – Convergence – Subsequences – Cauchy Sequences – Upper and Lower Limits - Some Special Sequences – Tests of convergence – Power series – Absolute convergence – Addition and multiplication of series – Rearrangements.

UNIT II (18 Periods)

Continuity: Limits of functions – Continuous functions – continuity and Compactness– Continuity and connectedness – Discontinuities – Monotonic functions – Infinite limits and limits at infinity. Differentiation: Derivative of a real function – Mean value Theorems - Intermediate value theorem for derivatives – L'Hospital's Rule – Taylor's Theorem – Differentiation of vector valued functions.

UNIT III (18 Periods)

Riemann – Stieltjes Integral: Definition and Existence – Properties – Integration and Differentiation – Integration of vector valued functions.

UNIT IV (18 Periods)

Sequences and series of functions: Uniform Convergence and Continuity – Uniform Convergence and Differentiation – Equi continuous families of functions – The Stone – Weierstrass Theorem.

UNIT V (18 Periods)

Functions of several variables: Linear Transformations - Differentiation – The Contraction Principle – The Inverse Function Theorem - The Implicit Function Theorem.

TEXT BOOK(S)

1. Walter Rudin, Principles of Mathematical Analysis, Third Edition, Mcgraw Hill, 1976.
   - UNIT I -Chapters 2 and 3
   - UNIT II -Chapters 4 and 5
   - UNIT III -Chapter 6
   - UNIT IV -Chapter 7
   - UNIT V -Chapter 9 Section 9.1 to 9.29

BOOKS FOR REFERENCE

1. Tom P. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
2. Serge Lang, Analysis I & II, Addison-Wesley Publishing Company, Inc. 1969

CORE COURSE - III
GRAPH THEORY

Semester : I **Max. Marks: 75**
Course Code: 18PMM1C3 **Credit: 05**
Total Periods: 90 **Exam Hours: 03**

Objectives:

To give a rigorous study of the basic concepts of Graph Theory and applications of Graph Theory in other disciplines

UNIT I BASIC RESULTS (18 Periods)

Basic Concepts - Subgraphs - Degrees of Vertices - Paths and Connectedness- Operations on Graphs - Directed Graphs: Basic Concepts - Tournaments.

UNIT II CONNECTIVITY (18 Periods)

Vertex Cuts and Edge Cuts - Connectivity and Edge - Connectivity, Trees: Definitions, Characterization and Simple Properties - Counting the Number of Spanning Trees - Cayley's Formula.

UNIT III INDEPENDENT SETS AND MATCHINGS (18 Periods)

Vertex Independent Sets and Vertex Coverings - Edge Independent Sets –Matchings and Factors - Eulerian Graphs - Hamiltonian Graphs.

UNIT IV GRAPH COLOURINGS (18 Periods)

Vertex Colouring - Critical Graphs - Triangle - Free Graphs - Edge Colourings of Graphs - Chromatic Polynomials

UNIT V PLANARITY (18 Periods)

Planar and Nonplanar Graphs - Euler Formula and its Consequences - K5 and K3,3 are Nonplanar Graphs - Dual of a Plane Graph - The Four-Colour Theorem and the Heawood Five-Colour Theorem-Kuratowski's Theorem.

TEXT BOOK(S)

1. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer International Edition, New Delhi, 2008

UNIT I - Chapter 1 & 2 Section 1.1 to 1.4, 1.7, 2.1 and 2.2
UNIT II - Chapter 3 & 4 Section 3.1, 3.2, 4.1, 4.3 to 4.4
UNIT III - Chapter 5 & 6 Section 5.1 to 5.4, 6.1, 6.2
UNIT IV - Chapter 7 Section 7.1 to 7.4, 7.7
UNIT V - Chapter 8 Section 8.1 to 8.6

BOOKS FOR REFERENCE

1. J.A. Bondy, U.S.R. Murty, Graph Theory with Applications, Mac Milan Press Ltd., 1976.
2. Gary Chartrand, Linda Lesniak, Ping Zhang, Graphs and Digraph,CRC press,2010

ELECTIVE - I
DISCRETE MATHEMATICS

Semester : I **Max. Marks: 75**
Course Code: 18PMM1E1A **Credit: 04**
Total Periods : 90 **Exam Hours: 03**

Objectives:

To study the concepts like Boolean algebra, coding theory and obtain the knowledge in grammar and Languages

UNIT I (18 Periods)

Relations and Functions: Binary relations, equivalence relations and partitions, partial order relations, inclusion and exclusion principle, Hasse diagram, Pigeon hole principle. Functions, inverse functions, compositions of functions, recursive functions

UNIT II (18 Periods)

Mathematical Logic: Logic operators, Truth tables, Theory of inference and deduction, mathematical calculus, predicate calculus, predicates and quantifiers.

UNIT III (18 Periods)

Lattices: Lattices as Partially Ordered Sets. Their Properties, Lattices as algebraic Systems, Sub lattices, Direct Product and homomorphism. Some Special Lattices - Complete, Complemented and Distributive Lattices, Isomorphic Lattices.

UNIT IV (18 Periods)

Boolean Algebra: Various Boolean identities, the switching Algebra Example, Sub Algebras, Direct Production and Homomorphism. Boolean Forms and their Equivalence, Midterm Boolean forms, Sum of Products, Canonical Forms. Minimization of Boolean Functions: Design Examples Using Boolean Algebra, Finite-state Machine

UNIT V (18 Periods)

Computability and Languages: Russell's Paradox and Non computability, Ordered Sets, Languages, Phrase structure grammars, Types of Grammars and Languages, Remarks and Reference

TEXT BOOK(S)

1. Trembly. J.P &Manohar.P., "Discrete Mathematical Structures with Applications to Computer Science" McGraw- Hill.
2. Liu, C.L., "Elements of Discrete Mathematics", McGraw-Hill Book co.
3. K.D Joshi, "Foundations of Discrete Mathematics", Wiley Eastern Limited.

UNIT I - Chapter 2 of [1], Chapter 4 of [2], Chapter 2 of [3]
UNIT II - Chapter 1 of [1]
UNIT III - Chapter 4 of [1]
UNIT IV - Chapter 4 of [1]
UNIT V - Chapter 2 of [2]

BOOKS FOR REFERENCE

1. Kolman, Busy & Ross, “Discrete Mathematical Structures”, PHI.
2. Trembly. J.P. & Manohar.P., “Discrete Mathematical Structures with Applications to Computer Science” McGraw-Hill

ELECTIVE - I
COMBINATORICS

Semester : I **Max. Marks: 75**
Course Code: 18PMM1E1B **Credit: 04**
Total Periods : 90 **Exam Hours: 03**

Objectives:

To introduce the notion of different types of distributions of objects and generating functions and study the Polya's enumeration theorems

UNIT I (18 Periods)

Permutations and combinations - distributions of distinct objects - distributions of non distinct objects - Stirlings formula

UNIT II (18 Periods)

Generating functions - generating function for combinations - enumerators for permutations - distributions of distinct objects into non-distinct cells -partitions of integers – the Ferrer's graphs - elementary relations

UNIT III (18 Periods)

Recurrence relation - linear recurrence relations with constant coefficients solutions by the technique of generating functions - a special class of nonlinear difference equations - recurrence relations with two indice

UNIT IV (18 Periods)

The principle of inclusion and exclusion - general formula - permutations with restriction on relative positions - derangements - the rook polynomials - permutations with forbidden positions

UNIT V (18 Periods)

Polya's theory of counting - equivalence classes under a permutation group Burnside theorem - equivalence classes of functions - weights and inventories of functions - Polya' s fundamental theorem – generation of Polya's theorem.

TEXT BOOK(S)

1. Introduction of Combinatorial Mathematics, C.L. Liu, McGraw Hill, 1968
   Chapters 1 to 5.

BOOKS FOR REFERENCE

1. Combinatorial Theory, Marshall Hall Jr.,John Wiley & Sons, second edition.
2. Combinatorial Mathematics, H.J. Rayser, Carus Mathematical Monograph, No.14.

APPLICATION ORIENTED COURSE - I
ORDINARY DIFFERENTIAL EQUATIONS

Semester : I **Max. Marks: 75**
Course Code: 18PMM1A1 **Credit: 03**
Total Periods : 90 **Exam Hours: 03**

Objectives:

To give an in-depth knowledge of differential equations and their applications and study the existence, uniqueness, stability behavior of the solutions of the ODE

UNIT I (18 Periods)

The general solution of the homogeneous equation– he use of one known solution to find another – The method of variation of parameters – Power Series solutions. A review of power series– Series solutions of first order equations – Second order linear equations; Ordinary points.

UNIT II (18 Periods)

Regular Singular Points – Gauss's hyper geometric equation – The Point at infinity - Legendre Polynomials – Bessel functions – Properties of Legendre Polynomials and Bessel functions.

UNIT III (18 Periods)

Linear Systems of First Order Equations – Homogeneous Equations with Constant Coefficients – The Existence and Uniqueness of Solutions of Initial Value Problem for First Order Ordinary Differential Equations – The Method of Solutions of Successive Approximations and Picard's Theorem.

UNIT IV (18 Periods)

Oscillation Theory and Boundary value problems – Qualitative Properties of Solutions– Sturm Comparison Theorems – Eigen values, Eigen functions and the Vibrating String.

UNIT V (18 Periods)

Nonlinear equations - Autonomous Systems; the phase plane and its phenomena –Types of critical points; Stability – critical points and stability for linear systems –Stability by Liapunov's direct method – Simple critical points of nonlinear systems.

TEXT BOOK(S)

1. G.F. Simmons, Differential Equations with Applications and Historical Notes, TMH, New Delhi, 1984.

   UNIT I - Chapter 3: Sections 15, 16, 19 and Chapter 5: Sections 25 to 27
   UNIT II - Chapter 5: Sections 28 to 31 and Chapter 6: Sections 32 to 35
   UNIT III - Chapter 7: Sections 37, 38 and Chapter 11: Sections 55, 56
   UNIT IV - Chapter 4: Sections 22 to 24
   UNIT V - Chapter 8: Sections 42 to 44

BOOKS FOR REFERENCE

1. W.T. Reid, Ordinary Differential Equations, John Wiley & Sons, New York, 1971
2. E.A. Coddington and N. Levinson, Theory of Ordinary Differential Equations, McGraw Hill Publishing Company, New York, 1955.

CORE COURSE - IV
LINEAR ALGEBRA

Semester : II **Max. Marks: 75**
Course Code: 18PMM2C4 **Credit: 05**
Total Periods : 90 **Exam Hours: 03**

Objectives:

To give the students a thorough knowledge of the various aspects of Linear Algebra and train the students in problem-solving as a preparatory for competitive exams

UNIT I (18 Periods)

Matrices: Systems of linear Equations - Matrices and Elementary Row operations -Row-reduced echelon Matrices - Matrix Multiplication - Invertible Matrices -Bases and Dimension.(Only revision of Vector spaces and subspaces)

UNIT II (18 Periods)

Linear Transformations: The algebra of linear transformations - Isomorphism of Vector Spaces - Representations of Linear Transformations by Matrices - Linear Functional– TheDouble Dual - The Transpose of a Linear Transformation.

UNIT III (18 Periods)

Algebra Of Polynomials: The algebra of polynomials - Lagrange Interpolation - Polynomial Ideals -The prime factorization of a polynomial - Commutative rings – Determinant functions.

UNIT IV (18 Periods)

Determinants: Permutations and the uniqueness of determinants - Classical Adjoint of a (square) matrix - Inverse of an invertible matrix using determinants -Characteristic values -Annihilating polynomials.

UNIT V (18 Periods)

Diagonalization: Invariant subspaces - Simultaneous triangulation and simultaneous Diagonalization Direct - sum Decompositions - Invariant Direct sums – Primary Decomposition theorem.

TEXTBOOK(S)

1. Kenneth Hoffman and Ray Alden Kunze, Linear Algebra, Second Edition, Prentice Hall of India Private Limited, New Delhi, 1975.
   - UNIT I - Chapter 1 & 2 Section 1.2-1.6 and 2.3
   - UNIT II - Chapter 3
   - UNIT III - Chapter 4 & 5 Section 4.1 - 4.5 and 5.1 - 5.2
   - UNIT IV - Chapter 5 & 6 Section 5.3, 5.4 and 6.1 - 6.3
   - UNIT V - Chapter 6 Section 6.4 - 6.8

BOOKS FOR REFERENCE

1. S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice-Hall of India Ltd, 2004.
2. A.R. Rao, P. Bhimashankaram, Linear Algebra, Second Edition, Tata McGraw Hill, 2000

CORE COURSE - V
COMPLEX ANALYSIS

Semester : II **Max. Marks: 75**
Course Code: 18PMM2C5 **Credit: 05**
Total Periods : 90 **Exam Hours: 03**

Objectives:

To learn the various intrinsic concepts and the theory of Complex Analysis and study the concept of Analyticity, Complex Integration and Infinite Products in depth

UNIT I (18 Periods)

Elementary Point Set Topology: Sets and Elements – Metric Spaces – Connectedness – Compactness – Continuous Functions – Topological Spaces; Conformality: Arcs and Closed Curves – Analytic Functions in Regions – Conformal Mapping – Length and Area; Linear Transformations: The Linear Group – The Cross Ratio – Symmetry

UNIT II (18 Periods)

Fundamental theorems in complex integration: Line Integrals – Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a Disk; Cauchy's Integral Formula: The Index of a Point with Respect to a Closed Curve – The Integral Formula – Higher Derivatives.

UNIT III (18 Periods)

Local Properties of Analytic Functions - Removable Singularities - Taylor's Theorem – Integral representation of the nth term - Zeros and Poles – Algebraic order of f(z) – Essential Singularity - The Local Mapping – The Open Mapping Theorem – The Maximum Principle.

UNIT IV (18 Periods)

The General Form of Cauchy's Theorem: Chains and Cycles – Simple Connectivity – Homology – The General Statement of Cauchy's Theorem – Proof of Cauchy's Theorem – Locally Exact Differentials – Multiply Connected Regions; The Calculus of Residues: The Residue Theorem – The Argument Principle – Evaluation of Definite Integrals

UNIT V (18 Periods)

Harmonic Functions: Definition and Basic Properties – The Mean-value Property – Poisson's Formula – Schwarz's Theorem – The Reflection Principle; Power series expansions-Weierstrass's Theorem – The Taylor Series – The Laurent Series;

TEXT BOOK(S)

1. Lars V. Ahlfors, Complex Analysis, Third Ed. McGraw-Hill Book Company, Tokyo, 1979.
   - UNIT – I -Chapter 3 Section 1.1 to 1.6, 2.1 to 2.4, 3.1-3.3
   - UNIT – II -Chapter 4 Section 1.1 to 1.5, 2.1 to 2.3
   - UNIT – III -Chapter 4 Section 3.1, 3.2, 3.3, 3.4
   - UNIT – IV -Chapter 4 Section 4.1 to 4.7, 5.1 to 5.3
   - UNIT – V -Chapter 4 Section 6.1 to 6.5, and Chapter 5 Section 1.1 to 1.3

BOOKS FOR REFERENCE

1. Serge Lang, Complex Analysis, Addison Wesley, 1977.
2. Karunakaran, Complex Analysis, Alpha Science international Ltd,Second Edition,2005.

CORE COURSE - VI
MEASURE THEORY AND INTEGRATION

Semester : II **Max. Marks: 75**

Course Code: 18PMM2C6 **Credit: 05**

Total Periods : 90 **Exam Hours: 03**

Objectives:

To generalize the concept of integration using measures and develops the concept of analysis in abstract situations

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UNIT I (18 Periods)

Measure on Real line - Lebesgue outer measure - Measurable sets - Regularity -Measurable function - Borel and Lebesgue measurability

UNIT II (18 Periods)

Integration of non-negative functions - The General integral - Integration of series -Riemann and Lebesgue integrals.

UNIT III (18 Periods)

Abstract Measure spaces - Measures and outer measures - Completion of a measure - Measure spaces - Integration with respect to a measure

UNIT IV (18 Periods)

Convergence in Measure- Almost uniform convergence - Signed Measures and Halin Decomposition - The Jordan Decomposition

UNIT V (18 Periods)

Measurability in a Product space – The product Measure and Fubini's Theorem

TEXT BOOK(S)

1. G. De Barra, Measure Theory and Integration, New age international (p) Limited.
   - UNIT I - Chapter 2 Sections 2.1 to 2.5
   - UNIT II - Chapter 3 Sections 3.1 to 3.4
   - UNIT III - Chapter 5 Sections 5.1 to 5.6
   - UNIT IV - Chapter 7 Sections 7.1 and 7.2, Chapter 8 Sections 8.1 and 8.2
   - UNIT V - Chapter 10 Sections 10.1 and 10.2

BOOKS FOR REFERENCE

1. P.K. Jain, V.P. Gupta, Lebesgue Measure and Integration, New Age International Pvt Limited Publishers, New Delhi, 1986, Reprint 2000.
2. Richard L. Wheeden and AntoniZygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc. 1977

ELECTIVE - II
MATHEMATICAL MODELING

Semester : II **Max. Marks: 75**
Course Code: 18PMM2E2A **Credit: 04**
Total Periods: 90 **Exam Hours: 03**

Objectives:

To study the mathematical models through ODE and Difference equations and train the students to develop mathematical models in real life problems

UNIT I (18 Periods)

Mathematical Modeling through Ordinary Differential Equations of First order**:** Linear Growth and Decay Models – Non-Linear Growth and Decay Models –Compartment Models – Dynamics problems – Geometrical problems.

UNIT II (18 Periods)

Mathematical Modeling through Systems of Ordinary Differential Equations of First Order: Population Dynamics – Epidemics – Compartment Models – Economics –Medicine, Arms Race, Battles and International Trade – Dynamics.

UNIT III (18 Periods)

Mathematical Modeling through Ordinary Differential Equations of Second Order: Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modeling through Linear Differential Equations of Second Order –Miscellaneous Mathematical Models.

UNIT IV (18 Periods)

Mathematical Modeling through Difference Equations: Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics –Probability Theory.

UNIT V (18 Periods)

Mathematical Modeling through Graphs: Solutions that can be Modeled through Graphs – Mathematical Modeling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs.

TEXT BOOK(S)

1. J.N. Kapur, Mathematical Modeling, Wiley Eastern Limited, New Delhi, 1988.
   - UNIT I - Chapter 2 Sections 2.1 to 2.6
   - UNIT II - Chapter 3 Sections 3.1 to 3.6
   - UNIT III - Chapter 4 Sections 4.1 to 4.4
   - UNIT IV - Chapter 5 Sections 5.1 to 5.5
   - UNIT V - Chapter 7 Sections 7.1 to 7.5

BOOK FOR REFERENCE

1. J. N. Kapur, Mathematical Models in Biology and Medicine, EWP New Delhi, 1985.

ELECTIVE - II
FLUID DYNAMICS

Semester : II **Max. Marks: 75**

Course Code: 18PMM2E2B **Credit: 04**

Total Periods: 90 **Exam Hours: 03**

Objectives:

To give the students an introduction to the behavior of fluids in motion and the students a feel of the applications of Complex Analysis in the analysis of the flow of liquids

UNIT I (18 Periods)

Real Fluids and Ideal Fluids - Velocity of a Fluid at a point – Streamlines and Path lines: Steady and Unsteady Flows – The Velocity potential – The Velocity vector – Local and Particle Rates of Change – The Equation of continuity – Worked examples – Acceleration of a Fluid – Conditions at a rigid boundary – General analysis of fluid motion – Pressure at a point in a Fluid at Rest – Pressure at a point in Moving Fluid – Conditions at a Boundary of Two Inviscid Immiscible Fluids – Euler's equation of motion – Bernoulli's equation – Worked examples.

UNIT II (18 Periods)

Discussions of a case of steady motion under conservative body forces – Some potential theorems – Some Flows Involving Axial Symmetry – Some special two- Dimensional Flows-Impulsive Motion. Some three- dimensional Flows: Introduction – Sources, Sinks and Doublets – Images in a Rigid infinite Plane – Axi-Symmetric Flows; Stokes stream function.

UNIT III (18 Periods)

Some Two- Dimensional Flows: Meaning of a Two- Dimensional Flow – Use of cylindrical polar co-ordinates – The stream function – The Complex Potential for Two- Dimensional, Irrotational , Incompressible Flow – complex velocity potentials for Standard Two Dimensional Flows – Some worked examples – The Milne- Thomson circle theorem and applications – The theorem of Blasius.

UNIT IV (18 Periods)

The use of conformal Transformation and Hydro dynamical Aspects – Vortex rows. Viscous flow Stress components in a real fluid - relations between cartesian components of stress - Translational Motion of Fluid element – The Rate of Strain Quadraic and Principle Stresses – Some further properties of the rate of strain quardric - Stress analysis in fluid motion – Relations between stress and rate of strain - The coefficient of viscosity and laminar flow – The Navier- Stokes equations of motion of a viscous fluid.

UNIT V (18 Periods)

Some solvable problems in viscous flow – Steady viscous flow in tubes of uniform cross section – Diffusion of vorticity – Energy Dissipation due to viscosity – Steady Flow past a Fixed Sphere – Dimensional Analysis; Reynolds Number – Prandtl's Boundary Layer.

TEXT BOOK(S)

1. Text Book of Fluid Dynamics by F.Chorlton , CBS Publishers & Distributors, New Delhi ,1985.
   UNIT I - Chapter 2 and Chapter 3 Section 3.1 to 3.6
   UNIT II - Chapter 3 Section 3.7 to 3.11 and chapter 4 Section 4.1, 4.2, 4.3, 4.5
   UNIT II - Chapter 5 Section 5.1 to 5.9 except 5.7
   UNIT IV - Chapter 5 Section 5.10, 5.12 and Chapter 8 Section 8.1 to 8.9
   UNIT V - Chapter 8 Section 8.10 to 8.16.

BOOKS FOR REFERENCE

1. Computational Fluid Dynamics: An Introduction, J.F. Wendt J.D. Anderson, G. Degrez and E. Dick, Springer – Verlag, 1996.
2. Computational Fluid Dynamics, The Basics with Applicatios, J. D. Anderson, McGraw Hill,1995.

APPLICATION ORIENTED COURSE - II
PARTIAL DIFFERENTIAL EQUATIONS

Semester : II **Max. Marks: 75**
Course Code: 18PMM2A2 **Credit: 03**
Total Periods : 90 **Exam Hours: 03**

Objectives:

To give an in-depth knowledge of solving partial differential equations and apply them in Scientific and Engineering problems and study the other aspects of PDE

UNIT I (18 Periods)

Partial differential equations- origins of first order Partial differential equations-Cauchy's problem for first order equations- Linear equations of the first order- Integral surfaces Passing through a Given curve- surfaces Orthogonal to a given system of surfaces -Nonlinear Partial differential equations of the first order.

UNIT II (18 Periods)

Cauchy's method of characteristics- compatible systems of first order equations - Charpits method- Special types of first order equations- Solutions satisfying given conditions- Jacobi's method

UNIT III (18 Periods)

Partial differential equations of the second order : The origin of second order equations–second order equations in Physics – Higher order equations in Physics - Linear partial differential equations with constant co-efficient- Equations with variable coefficients-Characteristic curves of second order equations

UNIT IV (18 Periods)

Characteristics of equations in three variables - The solution of Linear Hyperbolic equations - Separation of variables. The method of Integral Transforms – Non Linear equations of the second order

UNIT V (18 Periods)

Laplace equation - Elementary solutions of Laplace's equations-Families of equipotential Surfaces- Boundary value problems-Separation of variables –Problems with Axial Symmetry

TEXT BOOK(S)

1. Ian N. Sneddon, Elements of Partial differential equations**,** Dover Publication –INC, New York, 2006.
   - UNIT I - Chapter 2 Sections 1 to 7
   - UNIT II - Chapter 2 Sections 8 to 13
   - UNIT III - Chapter 3 Sections 1 to 6
   - UNIT IV - Chapter 3 Sections 7 to 11
   - UNIT V - Chapter 4 Sections 2 to 6

BOOKS FOR REFERENCE

1. M.D. Raisinghania, Advanced Differential Equations, S. Chand and company Ltd., New Delhi,2001
2. E.T. Copson**,** Partial Differential Equations, Cambridge University Press

CORE COURSE - VII
TOPOLOGY

Semester : III **Max. Marks: 75**
Course Code: 18PMM3C7 **Credit: 05**
Total Periods: 90 **Exam Hours: 03**

Objectives:

To study the concepts concerned with properties that are preserved under continuous deformations of objects and train the students to develop analytical thinking and the study of continuity and connectivity.

UNIT I (18 Periods)

Topological Spaces: Topological spaces - Basis for a topology - The order topology - The product topology on X &Y - The subspace topology - Closed sets and limit points.

UNIT II (18 Periods)

Continuous Functions: Continuous functions - the product topology - The metric topology.

UNIT III (18 Periods)

Connectedness: Connected spaces- connected subspaces of the Real line - Components and local connectedness.

UNIT IV (18 Periods)

Compactness: Compact spaces - compact subspaces of the Real line - Limit Point Compactness – Local Compactness.

UNIT V (18 Periods)

Countability And Separation Axioms: The countability Axioms - The separation Axioms - Normal spaces - The Urysohn Lemma - The Urysohn metrization Theorem - The Tietz extension theorem.

TEXT BOOK(S)

1.James R. Munkres, Topology (2nd Edition) Pearson Education Pvt. Ltd., New Delhi-2002 (Third Indian Reprint).

UNIT I - Chapter 2 Sections 12 to 17
UNIT II - Chapter 2 Sections 18 to 21 (Omit Section 22)
UNIT III - Chapter 3 Sections 23 to 25.
UNIT IV - Chapter 3 Sections 26 to 29.
UNIT V - Chapter 4 Sections 30 to 35.

BOOKS FOR REFERENCE

1 J. Dugundji, Topology, Prentice Hall of India, New Delhi, 1975.
2 L.Steen and J.Seeback, Counter examples in Topology, Holt, Rinehart and Winston, New York, 1970.

CORE COURSE - VIII
NUMERICAL ANALYSIS

Semester : III **Max. Marks: 75**

Course Code: 18PMM3C8 **Credit: 05**

Total Periods: 90 **Exam Hours: 03**

Objectives:

To know the theory behind various numerical methods and to apply these methods to solve mathematical problems

UNIT I (18 Periods)

Transcendental and polynomial equations:Rate of convergence – Secant Method, Regula Falsi Method, Newton Raphson Method, Muller Method and Chebyshev Method. Iterative Methods: Birge-Vieta method, Bairstow's method -Direct Method: Graeffe's root squaring method.

UNIT II (18 Periods)

System of Linear Algebraic equations: Error Analysis of Direct methods – Operational count of Gauss elimination, Vector norm, Matrix norm, Error Estimate. Iteration methods - Jacobi iteration method, Gauss Seidel Iteration method, Successive Over Relaxation method - Convergence analysis of iterative methods, Optimal Relaxation parameter for the SOR method.

UNIT III (18 Periods)

Interpolation and Approximation: Hermite Interpolations, Piecewise and Spline Interpolation – piecewise linear interpolation, piecewise quadratic interpolation, piecewise cubic interpolation, spline interpolation-cubic Spline interpolation. Bivariate Interpolation - Lagrange Bivariate interpolation. Least square approximation

UNIT IV (18 Periods)

Differentiation and Integration: Numerical Differentiation – Optimum choice of Step length – Extrapolation methods – Partial Differentiation. Numerical Integration: Methods based on undetermined coefficients - Gauss Legendre Integration method and Lobatto Integration Methods only.

UNIT V (18 Periods)

Ordinary differential equations – Singlestep Methods: Local truncation error or Discretization Error, Order of a method, Taylor Series method, Runge-Kutta methods: Explicit Runge–Kutta methods– Minimization of Local Truncation Error, System of Equations, Implicit Runge-Kutta methods. Stability analysis of single step methods (RK methods only)

TEXT BOOK(S)

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International (p) Limited Publishers, New Delhi, Third Edition 2012

UNIT I - Chapter 2 Section 2.5 & 2.8
UNIT II - Chapter 3 Section 3.3, 3.4
UNIT III - Chapter 4 Section 4.4 - 4.7 & 4.9
UNIT IV - Chapter 5 Section 5.2 - 5.6 & 5.8
UNIT V - Chapter 6 Section 6.3 & 6.6

BOOKS FOR REFERENCE

1. Kendall E. Atkinson, An Introduction to Numerical Analysis, II Edn., John Wiley & Sons, 1988.
2. M.K. Jain, Numerical Solution of Differential Equations, II Edn., New Age International Pvt Ltd., 1983.
3. Samuel. D. Conte, Carl. De Boor, Elementary Numerical Analysis, Mc Graw-Hill International Edn., 1983.

CORE COURSE - IX
FUNCTIONAL ANALYSIS

Semester : III **Max. Marks: 75**
Course Code: 18PMM3C9 **Credit: 04**
Total Periods: 90 **Exam Hours: 03**

Objectives

To study the three structure theorems of Functional Analysis viz., Hahn-Banach theorem, Open mapping theorem and Uniform boundedness principle and introduce Hilbert spaces and operator theory leading to the spectral theory of operators on a Hilbert space.

UNIT I (18 Periods)

Algebraic Systems: Groups – Rings – The structure of rings – Linear spaces – The dimension of a linear space – Linear transformations – Algebras – 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 II (18 Periods)

Hilbert Spaces: The definition and some simple properties – Orthogonal complements – Orthonormal sets - The conjugate space H* - The adjoint of an operator – Self-adjoint operators – Normal and unitary operators – Projections

UNIT III (18 Periods)

Finite-Dimensional Spectral Theory: Matrices – Determinants and the spectrum of an operator – The spectral theorem – A survey of the situation

UNIT IV (18 Periods)

General Preliminaries on Banach Algebras: The definition and some examples –Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the spectral radius – The radical and semi-simplicity

UNIT V (18 Periods)

The Structure of Commutative BanachAlgebras : The Gelfand mapping – Applications of the formula $r(x) = \lim \| x^n \|1/n$ - Involutions in Banach Algebras – The Gelfand- Neumark theorem.

TEXT BOOK(S)

1. G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill International Ed. 1963.

UNIT I - Chapters 8 and 9
UNIT II - Chapter 10
UNIT III - Chapter 11
UNIT IV - Chapter 12
UNIT V - Chapter 13

BOOKS FOR REFERENCE

1 Walter Rudin, Functional Analysis, TMH Edition, 1974.
2 B.V. Limaye, Functional Analysis, Wiley Eastern Limited, Bombay, Second Print, 1985.

CORE COURSE - X
CALCULUS OF VARIATIONS, TRANSFORMS AND INTEGRAL EQUATIONS

Semester : III **Max. Marks: 75**
Course Code: 18PMM3C10 **Credit: 04**
Total Periods: 90 **Exam Hours: 03**

Objectives:

To introduce the concept of calculus of variations and integral equations and their applications and study the different types of transforms and their properties.

UNIT I (18 Periods)

Calculus of variations – Maxima and Minima – the simplest case – Natural boundary and transition conditions - variational notation – more general case – constraints and Lagrange's multipliers – variable end points – Sturm - Liouville problems.

UNIT II (18 Periods)

Fourier transform - Fourier sine and cosine transforms - Properties Convolution -Solving integral equations - Finite Fourier transform - Finite Fourier sine and cosine transforms - Fourier integral theorem - Parseval's identity.

UNIT III (18 Periods)

Hankel Transform -Definition – Inverse formula – Some important results for Bessel function – Linearity property – Hankel Transform of the derivatives of the function – Hankel Transform of differential operators – Parseval's Theorem

UNIT IV (18 Periods)

Linear Integral Equations - Definition, Regularity conditions – special kind of kernels – eigen values and eigen functions – convolution Integral – the inner and scalar product of two functions – Notation – reduction to a system of Algebraic equations – examples – Fredholm alternative - examples – an approximate method.

UNIT V (18 Periods)

Method of successive approximations: Iterative scheme – examples – Volterra Integral equation – examples – some results about the resolvent kernel. Classical Fredholm Theory: the method of solution of Fredholm – Fredholm's first theorem – second theorem – third theorem.

TEXT BOOK(S)

1. Ram.P.Kanwal – Linear Integral Equations Theory and Practise, Academic Press1971.
2. F.B. Hildebrand, Methods of Applied Mathematics II ed. PHI, ND 1972
3. A.R. Vasishtha, R.K. Gupta, Integral Transforms, Krishna Prakashan Media Pvt Ltd, India, 2002.

UNIT I - Chapter 2 Sections 2.1 to 2.9 of [2]
UNIT II - Chapter 7 of [3]
UNIT III - Chapter 9 of [3]
UNIT IV - Chapters 1 and 2 of [1]
UNIT V - Chapters 3 and 4 of [1]

BOOKS FOR REFERENCE

1. S.J. Mikhlin, Linear Integral Equations (translated from Russian), Hindustan Book Agency, 1960.
2. I.N. Snedden, Mixed Boundary Value Problems in Potential Theory, North Holland, 1966

ELECTIVE - III
STOCHASTIC PROCESSES

Semester : III **Max. Marks: 75**
Course Code: 18PMM3E3A **Credit: 04**
Total Periods: 90 **Exam Hours: 03**

Objectives:

To understand the stochastic models for many real life probabilistic situations and learn the well known models like birth-death and queuing to reorient the knowledge of stochastic processes.

UNIT I (18 Periods)

Stochastic Processes: Some notions – Specification of Stochastic processes –Stationary processes – Markov Chains – Definitions and examples – Higher Transition probabilities – Generalization of independent Bernoulli trails – Sequence of chain –Dependent trains.

UNIT II (18 Periods)

Markov chains: Classification of states and chains – determination of Higher transition probabilities – stability of a Markov system – Reducible chains – Markov chains with continuous state space.

UNIT III (18 Periods)

Markov processes with Discrete state space : Poisson processes and their extensions –Poisson process and related distribution – Generalization of Poisson process- Birth and Death process – Markov processes with discrete state space (continuous time Markov Chains).

UNIT IV (18 Periods)

Renewal processes and theory: Renewal process – Renewal processes in continuous time – Renewal equation – stopping time – Wald's equation – Renewal theorems.

UNIT V (18 Periods)

Stochastic processes in Queuing – Queuing system – General concepts – the queuing model M/M/1 – Steady state Behavior – transient behavior of M/M/1 Model – Non-Markovian models - the model GI/M/1

TEXT BOOK(S)

1. J. Medhi, Stochastic Processes, New age international publishers, New Delhi–Second edition.
   - UNIT I - Chapter 2 & 3 Section 2.1 to 2.3, Section 3.1 to 3.3
   - UNIT II - Chapter 3 Section 3.4 to 3.6, 3.8, 3.9 and 3.11
   - UNIT III - Chapter 4 Section 4.1 to 4.5
   - UNIT IV - Chapter 6 Section 6.1 to 6.5
   - UNIT V - Chapter 10 Section 10.1 to 10.3, 10.7 and 10.8 (omit sec 10.2.3 & 10.2.3.1)

BOOKS FOR REFERENCE

1. Samuel Karlin, Howard M. Taylor, A first course in stochastic processes, Academic press, Second Edition, 1975
2. Narayan Bhat, Elements of Applied Stochastic Processes, John Wiley, 1972

ELECTIVE - III
OPTIMIZATION TECHNIQUES

Semester : III **Max. Marks: 75**

Course Code: 18PMM3E3B **Credit: 04**

Total Periods: 90 **Exam Hours: 03**

Objectives:

To introduce the various techniques of Operations Research and make the students solve real life problems in Business and Management

UNIT I (18 Periods)

Integer Programming

UNIT II (18 Periods)

Dynamic (Multistage) Programming

UNIT III (18 Periods)

Decision Theory and Games

UNIT IV (18 Periods)

Inventory Models

UNIT V (18 Periods)

Non-Linear Programming algorithms

TEXT BOOK(S)

1. Hamdy A.Taha, Operations Research (7thEdn.), Mc. Graw Hill Publications, New Delhi.

UNIT I	- Sections 8.1 to 8.5
UNIT II	- Sections 9.1 to 9.5
UNIT III	- Sections 11.1 to 11.4
UNIT IV	- Sections 13.1 to 13.4
UNIT V	- Sections 19.1 and 19.2

BOOKS FOR REFERENCE

1. O.L. Mangasarian, Non Linear Programming, McGraw Hill, New York

2. Prem Kumar Gupta and D.S. Hira, Operations Research: An Introduction, S. Chand and Co., Ltd., New Delhi.

CORE COURSE - XI
DIFFERENTIAL GEOMETRY

Semester : IV **Max. Marks: 75**
Course Code: 18PMM4C11 **Credit: 05**
Total Periods: 90 **Exam Hours: 03**

Objectives:

To introduce the notion of surfaces and their properties and study geodesics and differential geometry of surfaces

UNIT I (18 Periods)

Space Curves: Definition of a space curve - Arc length - tangent - normal and binormal– curvature and torsion - contact between curves and surfaces- tangent surface- involutes and evolutes- Intrinsic equations - Fundamental Existence Theorem for space curves - Helics

UNIT II (18 Periods)

Intrinsic Properties of A Surface: Definition of a surface - curves on a surface - Surface of revolution -

UNIT III (18 Periods)

Helicoids -Metric- Direction coefficients - families of curves- Isometric correspondence- Intrinsic properties

UNIT IV (18 Periods)

Geodesics: Geodesics - Canonical geodesic equations - Normal property of geodesics- Existence Theorems - Geodesic parallels - Geodesics curvature- Gauss- Bonnet Theorem -Gaussian curvature- surface of constant curvature.

UNIT V (18 Periods)

Non Intrinsic Properties of a Surface: The second fundamental form- Principal curvature - Lines of curvature - Developable –Developable associated with space curves and with curves on surface – Minimal surfaces - Ruled surfaces.

TEXT BOOK(S)

1. T.J. Willmore, An Introduction to Differential Geometry, Oxford University Press, (17thImpression) New Delhi 2002. (Indian Print).
   - UNIT I - Chapter 1 Sections 1 to 9
   - UNIT II - Chapter 2 Sections 1 to 3
   - UNIT III - Chapter 2 Sections 4 to 9
   - UNIT IV - Chapter 2 Sections 10 to 18
   - UNIT V - Chapter 3 Sections 1 to 8

BOOKS FOR REFERENCE

1. Wihelm Klingenberg: A course in Differential Geometry, Graduate Texts in Mathematics, Springer Verlag, 1978
2. J.A. Thorpe Elementary topics in Differential Geometry, Under - graduate Texts in Mathematics, Springer - Verlag 1979

CORE COURSE - XII
CLASSICAL DYNAMICS

Semester : IV **Max. Marks: 75**
Course Code: 18PMM4C12 **Credit: 05**
Total Periods: 90 **Exam Hours: 03**

Objectives:

To give a detailed knowledge of the mechanical system of particles and study the applications of Lagrange's and Hamilton's equations

UNIT I (18 Periods)

Introductory concepts: The mechanical system - Generalized Coordinates - constraints - virtual work - Energy and momentum.

UNIT II (18 Periods)

Lagrange's equation: Derivation and examples - Integrals of the Motion – Small oscillations.

UNIT III (18 Periods)

Special Applications of Lagrange's Equations: Rayleigh's dissipation function - impulsive motion - Gyroscopic systems - velocity dependent potentials.

UNIT IV (18 Periods)

Hamilton's equations: Hamilton's principle - Hamilton's equations – Other variational principles - phase space

UNIT V (18 Periods)

Hamilton - Jacobi Theory: Hamilton's Principal Function – The Hamilton - Jacobi equation - Separability.

TEXT BOOK(S)

1. Donald T. Greenwood, Classical Dynamics, PHI Pvt. Ltd., New Delhi-1985

UNIT I - Chapter 1 Sections 1.1 to 1.5

UNIT II - Chapter 2 Sections 2.1 to 2.4

UNIT III - Chapter 3 Sections 3.1 to 3.4

UNIT IV - Chapter 4 Sections 4.1 to 4.4

UNIT V - Chapter 5 Sections 5.1 to 5.3

BOOKS FOR REFERENCE

1. H. Goldstein, Classical Mechanics, (2nd Edition), Narosa Publishing House, New Delhi

2. Narayan Chandra Rana & Promod Sharad Chandra Joag, Classical Mechanics, Tata Mc Graw Hill, 1991.

CORE COURSE - XIII
MODERN PROBABILITY THEORY

Semester : IV **Max.Marks:75**
Course Code: 18PMM4C13 **Credit: 05**
Total Periods: 90 **Exam Hours: 03**

Objectives:

To introduce axiomatic approach to probability theory, to study some statistical characteristics, discrete and continuous distribution functions and their properties, characteristic function and basic limit theorems of probability.

UNIT I (18 Periods)

Random Events And Random Variables**:** Random events - Probability axioms - Combinatorial formulae - conditional probability - Bayes Theorem - Independent events - Random Variables - Distribution Function - Joint Distribution - Marginal Distribution - Conditional Distribution - Independent random variables - Functions of random variables.

UNIT II (18 Periods)

Parameters of The Distribution**:** Expectation- Moments - The Chebyshev Inequality - Absolute moments - Order parameters - Moments of random vectors - Regression of the first and second types.

UNIT III (18 Periods)

Characteristic Functions Properties of characteristic functions: Characteristic functions and moments - semi-invariants - characteristic function of the sum of the independent random variables - Determination of distribution function by the Characteristic function - Characteristic function of multidimensional random vectors - Probability generating functions.

UNIT IV (18 Periods)

Some Probability Distributions : One point , two point , Binomial - Polya – Hyper geometric - Poisson (discrete) distributions - Uniform - normal gamma - Beta - Cauchy and Laplace (continuous) distributions.

UNIT V (18 Periods)

Limit Theorems: Stochastic convergence - Bernoulli law of large numbers - Convergence of sequence of distribution functions - Levy-Cramer Theorems - de Moivre-Laplace Theorem - Poisson, Chebyshev, Khintchine Weak law of large numbers - Lindberg Theorem - Lyapunov Theorem - Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.

TEXT BOOK(S)

1. M. Fisz, Probability Theory and Mathematical Statistics, John Wiley and Sons, New York, 1963.
   - UNIT I - Chapter 1: Sections 1.1 to 1.7 Chapter 2: Sections 2.1 to 2.9
   - UNIT II - Chapter 3: Sections 3.1 to 3.8
   - UNIT III - Chapter 4: Sections 4.1 to 4.7
   - UNIT IV - Chapter 5: Section 5.1 to 5.10
   - UNIT V - Chapter 6: Sections 6.1 to 6.4, 6.6 to 6.9, 6.11 and 6.12.

BOOKS FOR REFERENCE

1. R.B. Ash, Real Analysis and Probability, Academic Press, New York, 1972
2. K.L.Chung, A course in Probability, Academic Press, New York, 1974.
3. R.Durrett, Probability: Theory and Examples, (2nd Edition) Duxbury Press, New York, 1996.

ELECTIVE - IV
AUTOMATA THEORY

Semester : IV **Max. Marks: 75**
Course Code: 18PMM4E4A **Credit: 04**
Total Periods: 90 **Exam Hours: 03**

Objectives:

To make the students to understand the nuances of Automata and Grammar and make them to understand the applications of these techniques in computer science

UNIT I (18 Periods)

Finite Automata and Regular expressions: Definitions and examples - Deterministic and Nondeterministic finite Automata - Finite Automata with -moves.

UNIT II (18 Periods)

Context free grammar: Regular expressions and their relationship with automation - Grammar - Ambiguous and unambiguous grammars - Derivation trees – Chomsky Normal form.

UNIT III (18 Periods)

Pushdown Automaton: Pushdown Automaton - Definition and examples - Relation with Context free languages.

UNIT IV (18 Periods)

Finite Automata and lexical analysis: Role of a lexical analyzer - Minimizing the number of states of a DFA - Implementation of a lexical analyzer.

UNIT V (18 Periods)

Basic parsing techniques: Parsers - Bottom up Parsers - Shift reduce - operator precedence - Top down Parsers - Recursive descent - Predictive parsers.

TEXT BOOK(S)

1. John E. Hopcroft and Jeffrey D. Ullman, Introduction to Automata theory, Languages and Computations, Narosa Publishing House, Chennai, 2000.
2. A.V. Aho and Jeffrey D. Ullman, Compiler Design, Narosa Publishing House, Chennai, 2002

UNIT I - Chapter 2 Sections 2.1 - 2.4 [1]
UNIT II - Chapter 2 Section 2.5, Chapter 4 Sections 4.1 - 4.3, 4.5, 4.6 [1]
UNIT III - Chapter 5 Section 5.2, 5.3 [1]
UNIT IV - Chapter 3 Section 3.1 - 3.8 [2]
UNIT V - Chapter 5 Section 5.1 - 5.5 [2]

BOOKS FOR REFERENCE

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall, 1997
2. A.V. Aho, Monica S. Lam, R. Sethi, J.D. Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Addison-Wesley, 2007

ELECTIVE - IV
FUZZY MATHEMATICS

Semester : IV **Max. Marks: 75**

Course Code: 18PMM4E4B **Credit: 04**

Total Periods: 90 **Exam Hours: 03**

Objectives:

To introduce the various techniques of Fuzzy Mathematics

UNIT I (18 Periods)

Fuzzy sets – Basic types – Basic concept – α-cuts – Additional properties of α-cuts – Extension principle for Fuzzy sets

UNIT II (18 Periods)

Operations on Fuzzy sets – Types of operations – Fuzzy complements – t-Norms– Fuzzy Unions – Combinations of operations.

UNIT III (18 Periods)

Fuzzy Arithmetic – Fuzzy numbers – Arithmetic operations on intervals –Arithmetic operations on Fuzzy numbers.

UNIT IV (18 Periods)

Fuzzy relations – Binary fuzzy relations – Fuzzy equivalence relations – Fuzzy compatibility relations – Fuzzy ordering relations – fuzzy morphisms

UNIT V (18 Periods)

Fuzzy Relation Equations – General discussion – Problem partitioning – Solution method – Fuzzy Relation Equations based on Sup-i Compositions – Fuzzy Relation Equations based on inf-ωi Compositions.

TEXT BOOK(S)

1. George J.Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, New Delhi, 2004.

UNIT I	- Chapter 1 Sections 1.4; Chapter 2 Sections 2.1 & 2.3
UNIT II	- Chapter 3 Sections 3.1 to 3.5
UNIT III	- Chapter 4 Sections 4.1 to 4.4
UNIT IV	- Chapter 5 Sections 5.3 to 5.8
UNIT V	- Chapter 6 Sections 6.1 to 6.5

BOOKS FOR REFERENCE

1. H.J. Zimmermann, Fuzzy Set Theory and its Applications, Allied Publishers Limited, New Delhi, 1991.
2. G.J. Klir and B. Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, New Delhi, 1995