CC – I LINEAR ALGEBRA

Objectives:

1. To study Linear Transformations and its properties
2. To study the Algebra of Polynomials and Annihilating Polynomials
3. To study Invariant space and its properties

UNIT – I :

Systems of linear Equations – Matrices and Elementary Row operations – Row -Reduced Echelon matrices – Matrix multiplication – Invertible matrices – Vector spaces – Subspaces –Bases and Dimension – Co-ordinates.

UNIT – II :

The algebra of linear transformations – Isomorphism of vector spaces – Representations of Linear Transformations by Matrices – Linear functionals – The Double Dual – The Transpose of Linear Transformation.

UNIT – III :

The algebra of polynomials – Lagrange Interpolation – Polynomial Ideals – The prime factorization of a polynomial, commutative rings – Determinant functions –permutations and the uniqueness of determinants – Classical Adjoint of a (square)matrix – Inverse of an invertible matrix using determinants.

UNIT – IV :

Characteristic values – Annihilating polynomials, Invariant subspaces –simultaneous triangulation and simultaneous Diagonalization – Directsum – Decompositions.

UNIT – V :

Invariant Direct sums – The primary Decomposition Theorem – Cyclic subspaces – Cyclic Decompositions and the Rational Form.

TEXT BOOK :

[1] Kenneth Hoffman and Ray kunze, Linear Algebra second Edition, prentice –Hall of India private limited, New Delhi.1971.

UNIT I : chapter 1 and chapter 2: (sections 2.1 to 2.4)
UNIT II : chapter 3
UNIT III : chapter 4 and chapter 5 : (sections 5.1 to 5.4)
UNIT IV : chapter 6 (sections 6.1 to 6.6)
UNIT V : chapter 6 (sections 6.7, 6.8) and chapter 7(sections 7.1, 7.2)

REFERNCES:

[1] I.N .Herstein,Topics in Algebra,wiley Eastern Limited, New Delhi, 1975
[2] I.S.Luther and I.B.S. passi, Algebra, volume II – Rings , Narosa publishing House , 1999.
[3] N. Jacobson. Basic Algebra,vols. I and II Freeman. 1980 (also pulished by Hindustan Publishing Company)

CC – II REAL ANALYSIS

Objectives:

1. To provide the knowledge about the various aspects of Real Line and Metric spaces.
2. To introduce a complete Topological approach in all aspects of Analysis

UNIT – I :

Basic Topology : Finite Countable and Uncountable sets – Metric spaces – Compact sets – Perfect sets – Connected sets.

Continuity: Limits of functions – Continuous functions – Continuity and Compactness – Continuity and Connectedness – Discontinuities – Monotonic functions – Infinite limits and limits at infinity.

UNIT – II :

Differentiation :The derivative of a real function – Mean value theorems – The Continuity of derivatives – L'Hospital's rule – Derivatives of higher order – Taylor's theorem – Differentiation of vector – Valued functions.

UNIT – III :

The Riemann – Stieltjes Integral : Definitions and Existence of the integral –Properties of the integral – Integration and Differentiation – Integration of vector valued Functions – Rectifiable curves.

UNIT– IV :

Sequences and Series of functions: Discussion of Main problem – Uniform convergence – Uniform convergence and Continuity – Uniform convergence and Integration – Uniform convergence and Differentiation – Equicontinuous families of functions – The Stone - Weierstrass theorem.

UNIT– V :

Functions of several variables: Linear Transformations, Differentiation –The Contraction principle – The Inverse function theorem (Statement only) –The implicit function theorem (Statement only).

TEXT BOOK:

[1]. Walter Rudin, Principles of Mathematical Analysis, Third Edition, McGraw Hill, 1976

UNIT - I : Chapter 2 and Chapter 4
UNIT - II : Chapter 5
UNIT - III : Chapter 6
UNIT - IV : Chapter 7
UNIT - V : Chapter 9 (sections 9.1 to 9.2.9)

REFERENCE :

[1] Tom. M. Apostol, Mathematical Analysis, Narosa publishing House, New Delhi,1985

CC – III ORDINARY DIFFERENTIAL EQUATIONS

Objectives:

1. To study in detail about the second order differential equations and their power series solutions.
2. To analyze the stability of non-linear differential equations.

UNIT – I:

The general solution of the homogeneous equation – The 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:

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

UNIT– III:

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:

Qualitative Properties of Solutions: Oscillations and the Sturm Separation theorem – The Sturm Comparison Theorem

UNIT– V:

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:

[1] George.F.Simmons, Differential Equations with Applications and Historical Notes, TMH, New Delhi, 2003.

UNIT– I : Chapter 3(Sections 15, 16, 19) and Chapter 5 (Sections 26 to 28)
UNIT –II : Chapter 5 (Sections 29 to 32) and Chapter 6 (Sections 44 to 47)
UNIT– III : Chapter 10 (Sections 55, 56) and Chapter 13 (Sections 68, 69)
UNIT –IV : Chapter 4 (Sections 24, 25)
UNIT– V : Chapter 11 (Sections 58 to 62)

REFERENCES:

[1] W.T.Reid, Ordinary Differential Equations,JohnWiley and Sons, New York.

[2] E.A.Coddington and N.Levinson, Theory of Ordinary Differential Equations, Tata McGraw Hill Publishing Company Limited, New Delhi, 1972.

CC – IV GRAPH THEORY

Objectives:

1. To introduce the basic concepts of Graph Theory.
2. To give applications of Graph Theory .

UNIT – I :

Graphs, Subgraphs and Trees; Graphs and simple graphs – Graph Isomorphism – The Incidence and Adjacency Matrices – Subgraphs – Vertex Degrees – Paths and Connection – Cycles – Trees – Cut Edges and Bonds – Cut Vertices.

UNIT – II :

Connectivity, Euler Tours and Hamilton Cycle: Connectivity – Blocks – Euler Tours – Hamilton Cycles.

UNIT – III:

Matchings, Edge Colourings: Matchings – Matchings and Coverings in Bipartite Graphs – Edge Chromatic Number – Vizing's Thoerem.

UNIT – IV :

Independent sets and Cliques, Vertex Colourings: Independent sets – Ramsey's Theorem – Chromatic Number – Brook's Theorem – Chromatic Polynomials.

UNIT – V :

Planar graphs : Plane and Planar Graphs – Dual graphs-Euler's Formula – The Five – Colour theorem and the four – Colour Conjecture.

TEXT BOOK:

[1] J.A., Bondy and U.S.R Murthy, Graph Theory with Applications, Macmillan,London,1976

UNIT - I : Chapter 1(sections 1.1 to 1.7), Chapter 2 (sections 2.1 to 2.3)
UNIT – II : Chapter 3 (sections 3.1, 3.2), Chapter 4 (sections 4.1, 4.2)
UNIT - III : Chapter 5 (sections 5.1, 5.2), Chapter 6 (sections 6.1, 6.2)
UNIT – IV : Chapter 7 (sections 7.1, 7.2),Chapter 8 (sections 8.1, 8.2, 8.4)
UNIT – V : Chapter 9 (sections 9.1 to 9.3, 9.6)

REFERENCE :

J. Clark and D.A Holten, A First look at Graph theory, Allied Publishers, New Delhi,1995.

CC – V ALGEBRA

Objectives:

1. To introduce the various algebraic structures.
2. To study the properties of these structures.

UNIT – I :

Group Theory : Cayley's theorm – Permutation groups – Another counting principle – Sylow's theorem – Direct Products – Finite Abelian Groups.

UNIT – II :

More Ideals and Quotient rings – Polynomial rings – Polynomial over the rational field – Polynomial rings over Commutative rings.

UNIT – III :

Modules : Inner Product spaces – Orthogonal Complement – Orthogonal Basis –left module over a Ring – Submodule – Quotient module – Cyclic module – Structure Theorem for Finitely Generated Modules over Euclidean Rings.

UNIT - IV :

Fields : Extension Fields – Roots of Polynomials – More about roots,

UNIT – V :

The Elements of Galois Theory – Solvability by Radicals – Finite Fields.

TEXT BOOK :

[1] I.N Herstein,Topics in Algebra,Second Edition John wiley and Sons, 1975

UNIT – I : Chapter 2 (sections 2. 9, 2.10, 2.11, 2.12, 2.13, 2.14)
UNIT -II : Chapter 3 (sections 3.5, 3.9, 3.10, 3.11)
UNIT - III : Chapter 4 (sections 4.4, 4.5)
UNIT - IV : Chapter 5 (sections 5.1, 5.3, 5.5)
UNIT - V : Chapter 5 (sections 5.6, 5.7) and Chapter 7 (Section 7.1)

REFERENCE (S) :

[1] Surjeet Singh Qazi Zammeruddin,Modern Algebra,Vikas Publishing House private Limited, 1972.

[2] John B.Fraleigh ,A first course in Abstract Algebra, Pearson Education private Limited, 2003.

[3] Vijay K.Khanna and S.K Bhambri, A course in Abstract Algebra, Vikas Publishing House private Limited, 1993.

CC – VI COMPLE X ANALYSIS

Objectives:

1. To study several on facts on complex integration.
2. To study the of harmonic functions and its properties
3. To study infinite products and their properties.

UNIT – I :

Conformality :Arcs and Closed Curve – Analytic Functions in Regions – Conformal Mapping – Length and Area . Linear Transformations: The Linear Group – The CrossRatio – Symmetry.

UNIT – II :

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 :

Local Properties of Analytic Functions: Removable singularities – Taylor's Theorem – Integral representation of the n^{th} term – Zeros and poles – The Local mapping – The maximum principle .

UNIT – IV :

The General Form of Cauchy's Theorem : Chains and Cycles – Simple connectivity – Multiply Connected Regions. The Calculus of Residues: The Residue Theorem – The Argument Principle – Evaluation of Definite Integrals.

UNIT – V :

Harmonic Functions :Definition and Basic Properties – The mean value Property – Poisson's Formula – Schwarz's Theorem – Power Series expansions: Weierstrass's Theorem – The Taylor Series – The Laurent Series.

TEXT BOOK:

[1] Lars.V.Ahlfors,Complex Analysis, Third Edition McGraw-Hill book company,Tokyo.

UNIT - I : Chapter 3 (sections 2.1 to 2.4 , 3.1 to 3.3)
UNIT - II : Chapter 4 (sections 1.1 to 1.5, 2.1 to 2.3)
UNIT - III : Chapter 4 (sections 3.1 to 3.4)
UNIT - IV : Chapter 4 (sections 4.1, 4.2, 4.7, 5.1 to 5.3)
UNIT - V : Chapter 4 (sections 6.1 to 6.4) Chapter 5: (sections 1.1 to 1.3)

REFERENCES :

[1] S.Ponnusamy ,Foundation of complex Analysis, Narosa Publishing House .1995
[2] V.Karunakaran, complex analysis, Narosa publishing House, 2005.

CC – VII THEORY OF NUMBERS

Objectives

1. To expose the students to the fascination, facts and touch in the world of numbers.
2. To highlight some of the Applications of the Theory of Numbers.

UNIT – I :

Fundamentals of Congruence's – Basic properties of Congruence's – Residue Systems – Solving Congruence's: Linear Congruence's – The Theorems of Fermat and Wilson Revisited

UNIT – II :

The Chinese Remainder Theorem – Polynomial Congruence's. Arithmetic functions: Combinatorial study of Φ (n) – Formulae for d (n) and σ (n) – Multiplicative Arithmetic functions – The mobius Inversion formula

UNIT – III :

Quadratic Residues – Euler's criterion – The Legendre symbol – The Quadratic reciprocity law – Applications of the Quadratic reciprocity law

UNIT – IV :

Sums of squares : sums of two squares – Sums of Four Squares – Elementary Partition theory – Graphical representation – Euler's partition theorem – Searching for partition identities .

UNIT – V:

Partition Generating Function – Infinite products as Generating functions –Identities between infinite series and Products – Partitions Identities – History and Introduction – Euler's Pentagonal number theorem.

TEXT BOOK :

[1]George E.Andrews,Number theory.Hindustan Publishing corporation, 1989

UNIT - I : Chapter 4 (sections 4.1, 4.2) and Chapte5 (sections 5.1,5.2)
UNIT – II : Chapter 5 (sections 5.3,5.4) and Chapter 6(sections 6.1 to 6.4)
UNIT - III : Chapter 9 (sections 9.1 to 9.4)
UNIT - IV : Chapters 11 and 12
UNIT - V : Chapter 13 and Chapter 14 (sections14.1 to 14.3)

REFERENCE :

[1] Dr . Sudhir Pundir and Dr.Rimple Pundir, Theory of Numbers, First Edition, Pragasiprakashan Publications, 2006.

CC – VIII PARTIAL DIFFERENTIAL EQUATIONS

Objectives:

1. To give an in-depth knowledge of solving partial differential equations.
2. To introduce different types of second order partial differential equations.

UNIT – I :

First order P.D.E – Curves and surfaces – Genesis of First order P.D.E. – Classification of Integrals – Linear Equation of the First Order

UNIT – II :

Pfaffian Differential Equations – Compatible systems – Charpit's Method – Jacobi's Method – Integral surfaces through a given curve.

UNIT – III:

Second order P.D.E: Genesis of second order P.D.E. – Classification of second order P.D.E. One - Dimensional wave Equation – Vibrations of an Infinite string – Vibrations of a semi – Infinite string

UNIT – IV :

Vibrations of a string of finite Length (Method of separation of variables) Laplace's Equation : Boundary value problems – Maximum and Minimum principles – The Cauchy problem – The Dirichlet problem for the upper Half plane – The Neumann problem for the upper Half plane

UNIT – V :

The Dirichlet interior problem for a circle – The Dirichlet Exterior problem for a circle – The Neumann problem for a circle – The Dirichlet problem for a Rectangle – Harnack's Theorem – Laplace's Equation – Green's Functions.

TEXT BOOK:

[1] T.Amaranath, An Elementary Course in Partial Differential Equations, second Edition, Narosa publishing House ,New Delhi ,1997.

UNIT - I : Chapter 1 (sections 1.1 to 1.4)
UNIT - II : Chapter 1 (sections 1.5 to 1.9)
UNIT - III : Chapter 2 (sections 2.1 to 2.3.3)
UNIT - IV : Chapter 2 (sections 2.3.5, 2.4 to 2.4.5)
UNIT - V : Chapter 2 (sections 2.4.6 to 2.4.11)

REFERENCE :

[1] I.N . Sneddon. Elements of partial Differential Equations, McGraw – Hill International Editions 1957.

CC – IX MEASURE THEORY AND INTEGRATION

Objectives:

1. To study a basic course in Lebesgue Measure and Integration and a study of inequalities and the Lp-spaces.
2. To study signed measures and decomposition theorems.

UNIT – I :

Measure on the Real Line – Lebesgue Outer Measure – Measurable Sets – Regularity – Measurable Function – Borel and Lebesgue Measurability.

UNIT – II :

Integration of Non-negative Functions – The General Integral – Integration of Series – Riemann and Lebesgue Integrals.

UNIT– III :

Abstract Measure Spaces : Measures and outer Measures – Completion of a Measure – Measure spaces – Integration with respect to a Measure.

UNIT – IV :

Convergence in Measure – Almost Uniform Convergence – Singed Measures and Hahn Decomposition – The Jordan Decomposition.

UNIT – V :

Measurability in a Product Space – The Product Measure and Fubini's Theorem. The Radon – Nikodym Theorems and Applications.

TEXT BOOK:

[1] G.de Barra, Measure Theory and Introduction, First Edition, New Age International private Limited, 1981.

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 , 5.4 , 5.5 , 5.6)
UNIT – IV : Chapter 7 (sections 7.1 , 7.2) and Chapter 8(sections 8.1, 8.2)
UNIT – V : Chapter 10 (sections 10.1, 10.2) and Chapter 8 (section 8.3)

REFERENCES :

[1] Inder K.Rana, An Introduction to Measure and Integration, Narosa Publishing House, New Delhi, 1997.

[2] M.E Munroe, Measure and Integration, Second Edition, Addition – Wesley Publishing Company, 1971.

[3] P.K. Jain, V.P Gupta, Lebesgue Measure and Integration, New Age International Pvt. Ltd. Publishers, New Delhi, 1986 (Reprint 2000)

[4] Richard L. Wheeden and Andoni Zygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc 1977.

CC – X TOPOLOGY

Objectives:

1. To generalize the concepts the students have learnt in Real Analysis.
2. To train the students to develop analytical thinking.

UNIT – I :

Topological Spaces : Topological Spaces – Basis for a Topology – The order Topology. The Product Topology on X x Y – The Subspace Topology.

UNIT – II :

Closed Sets and Limit points – Continuous Functions : Continuous Functions – The Product Topology.

UNIT – III :

Connectedness : Connected Spaces – Connected Subspaces of the Real Line –Components and Local Connectedness

UNIT – IV :

Compactness: Compact Spaces – Compact Subspaces of the Real Line – Limit point Compactness – Local Campactness

UNIT – V :

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 :

[1] James R.Munkres, Topology, Second Edition, Prentice – Hall of India Private Limited, New Delhi, 2000.

UNIT - I : Chapter 2 (Sections 12 to 16)
UNIT - II : Chapter 2 (Sections 17 to 19)
UNIT - III : Chapter 3 (Sections 23 to 25)
UNIT - IV : Chapter 3 (Sections 26 to 29)
UNIT - V : Chapter 4 (Sections 30 to 35)

REFERENCES :

[1] J. Dugundji, Topology, Prentice Hall of India, New Delhi, 1976.
[2] Sheldon W. Davis, Topology, UBS Publishers Distributors Private Limited, New Delhi, 1989.

CC – XI STOCHASTIC PROCESSES

Objectives:

1.To introduce the concept of discrete and continuous time Marko chains and their Properties.

2.To study the renewal process and related results and their applications.

3. To learn more about several queuing models and their performance measures.

UNIT – I :

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 chains – Dependent trials.

UNIT – II :

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:

Markov processes with Discrete state space: Poission processes and its Extensions – Poission processes and related distributions – Birth and Death process – Markov Processes with discrete state space (Continuous time Markov Chains).

UNIT – IV :

Renewal Processes and Theory : Renewal Process – Renewal Processes in continuous time – Renewal equations – Stopping time – Wald's equation – Renewal theorems.

UNIT – V :

Stationary Processes and Time Series: Models of Time Series – Time and Frequency domain: Power Spectrum – Statistical Analysis of Time Series.

TEXT BOOK:

[1] J.Medhi, Stochastic Processes, Second Edition, New Age International Private Limited, New Delhi, 1994.

UNIT - I : Chapter2(Sections2.1to2.3,)andChapter3(Sections 3.1to 3.3)
UNIT - II : Chapter 3 (Sections 3.4 to 3.6, 3.9 and 3.11)
UNIT - III : Chapter 4 (Sections 4.1, 4.2, 4.4, 4.5)
UNIT - IV : Chapter 6 (Sections 6.1 to 6.5)
UNIT - V : Chapter 8 (Sections 8.2 to 8.4)

REFERENCES :

[1] Srinivasan and Metha, Stochastic Processes,
[2] Samuel Korlin, Howard M.Taylor,A First course in Stochastic Processes,Second Edition.
[3] Narayan Bhat, Elements of Applied Stochastic Processes.
[4] N.V.Prabhu, Macmillan(NY), Stochastic Processes.

CC – XII DIFFERENTIAL GEOMETRY

Objectives:

1. To help the students to understand the use of differential calculus in the field of genetics.
2. To help the students to distinguish between plane curves and space curves using differentiations**.**

UNIT – I :

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 – Helices.

UNIT – II :

Intrinsic properties of a surface : Definition of a Surface – curves on a Surface – Surface of revolution – Helicoids – Metric – Direction Coefficients – Families of curves.

UNIT – III :

Geodesics : Geodesics – Canonical Geodesic Equations – Normal Property of Geodesics – Existence Theorems.

UNIT – IV:

Geodesic parallels – Geodesic curvature – Gauss Bonnet Theorem – Gaussian curvature – surface of constant curvature.

UNIT – V :

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:

[1] T.J Willmore, An Introduction to Differential Geometry, Oxford University press (20^{th} Impression), New Delhi 2005 (Indian Print)

UNIT I : Chapter 1 (sections 1 to 9)
UNIT II : Chapter 2 (sections 1 to 7)
UNIT III : Chapter 2 (sections 10 to 13)
UNIT IV : Chapter 2 (sections 14 to 18)
UNIT V : Chapter 3 (sections 1 to 8)

REFERENCE(S) :

[1] Wihelm Klingenbery, A course in Differential Geometry, Graduate Texts in Mathematics, Springer verlag, 1978.

[2] Struik, D.T Lectures on classical Differential Geometry, Addison – Wesley,Mass, 1950.

[3] J.A Thorpe, Elementary topics in Differential Geometry, Under graduate Texts in Mathematics, Springer – verlag, 1979.

CC – XIII FUNCTIONAL ANALYSIS

Objectives:

1. To study Banach spaces and to study their structure theorems of functional Analysis.
2. To study Hilbert spaces and operator theory leading to the spectral theory operator on a Hilbert spaces.

UNIT – I :

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 :

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 :

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

UNIT – IV :

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

UNIT – V :

The structure of Commutative Banach Algebras : The Gelfand Mapping – Applications of the formula $r(x) = \lim ||x^n||^{1/n}$ – Involutions in Banach Algebras – The Gelfand – Neumann Theorem .

TEXT BOOK:

[1] G.F. Simmons, Introduction to Topology and Modern Analysis, Tata McGraw – Hill International Edition, 1963.

UNIT - I : Chapter 9
UNIT - II : Chapter 10
UNIT - III : Chapter 11
UNIT - IV : Chapter 12
UNIT - V : Chapter 13

REFERENCE(S):

[1] B.V Limaye, Functional Analysis, New Age International Private Limited, 1996.
[2] Walter Rudin, Functional Analysis, TMH Edition, 1974.
[3] K. Yosida, Functional Analysis, Springer - Verlag, 1974.
[4] Laurent Schwarz, Functional Analysis, Courant Institute of Mathematical Sciences, New York University, 1964

CC – XIV - INTEGRAL EQUATIONS, CALCULUS OF VARIATIONS AND FOURIER TRANSFORM

Objectives:

1. To solve differential equations using variational methods.
2. To introduce Fredhlom & Volterra Integral equations and to study The methods of solving the above equations.
3. To introduce Fourier Transform.

UNIT – I :

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 – Strum Liouville problems.

UNIT – II :

Fourier Transform – Fourier sine ands cosine transforms – properties – convolution – solving Integral equations – Finite fourier transforms – Finite Fourier sine and cosine transforms – Fourier Integral Theorem – Parseval's identity.

UNIT – III :

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 – Parsaval's Theorem.

UNIT – IV :

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 :

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 BOOKS:

[1] Ram. P. Kanwal, Linear Integral Equations Theory and Technique, Academic Press 1971.

[2] F.B. Hildebrand, Methods of Applied Mathematics, second Edition, PHI, New Delhi, 1972.

[3] A.R.Vasishtha and R.K.Gupta, Integral Transforms, second Revised Edition Krishna Prakashan Media, Private Limited, India. 1975.

UNIT - I : Chapter 2 (sections 2.1 to 2.9) of (2)
UNIT - II : Chapter 6 and Chapter 7 (sections 7.1 to 7.4) of [3]
UNIT - III : Chapter 9 of [3]
UNIT - IV : Chapters 1 and 2 of [1]
UNIT - V : Chapters 3 and 4 of [1]

REFERENCE:

[1] I.N.Shedden, Mixed Boundary value problems in practical Theory, North Holland, 1966.

ELECTIVE COURSE – I
MATHEMATICAL PROBABILITY

Objective:

1. To make the students gain in-depth knowledge in probability which plays a main role in solving real life problems.

UNIT – I :

Probability – Mathematical Probability – Axiomatic approach to probability – Addition and multiplication theorem (two events only) – Boole's Inequality, Baye's theorem – Simple problems.

UNIT – II :

Random variables – Concepts – One dimensional random variable – Discrete and continuous r.v – Probability mass function – Probability density function – Distribution function – Simple problems. Two dimensional random variables – Discrete – Continuous random variables – Marginal, conditional probability functions – Simple problems.

UNIT – III:

Mathematical expectation – Definition – Properties of expectation. Variance – Properties of variance ,covariance (concept only) – Simple problems – Conditional expectations and conditional variance (concept only) – Simple problems.

UNIT – IV :

Moment generating function (m.g.f) – Definition – Properties of m.g.f –Cumulant generating function – Properties of cumulants – Characteristic function – Definition – Properties of characteristic function.

UNIT – V :

Binomial and Poisson distribution – Definition – Applications – m.g.f.– Properties – Recurrence relation for the moments – Charteristic function – Additive property –Simple problems only.

TEXT BOOK :

[1] S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical statistics – Sultan chand and sons. Educational publishers, Reprint – 2003

UNIT – I : Chapter 3 (sections 3.4, 3.8, 3.8.5, 3.9, 3.9.1 to 3.9.3, 3.11) Chapter 4 (section 4.2)
UNIT - II :Chapter 5 (sections 5.1 to 5.4, 5.4.1, 5.4.3, 5.5, 5.5.1)
UNIT - III :Chapter 6 (sections 6.2, 6.4, 6.5, 6.9)
UNIT - IV :Chapter 7 (sections 7.1, 7.1.2, 7.1.3, 7.2, 7.3, 7.3.1)
UNIT - V : Chapter (sections 8.4, 8.4.2, 8.4.6 to 8.4.8, 8.5, 8.5.4 to 8.5.6)

ELECTIVE COURSE – II

FUZZY MATHEMATICS

Objectives:

1. To give an introduction to the basic concepts of fuzzy set theory
2. To make the students understand the nuances of Fuzzy Analysis.
3. To make them understand the applications of these techniques in computer.

UNIT – I :

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

UNIT – II :

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

UNIT – III :

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

UNIT – IV :

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

UNIT – V :

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 :

[1] George J.klir and B.yuan, Fuzzy sets and Fuzzy Logic, prentice Hall of India, New Delhi, 2004.

UNIT - I : Chapter 1 (sections 1.3, 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 ,4.3, 4.4)
UNIT - IV : Chapter 5 (sections 5.3, 5.5 to 5.8)
UNIT -V : Chapter 6 (sections 6.1 to 6.5)

REFERENCE :

[1] H.J.Zimmermann, Fuzzy Set Theory and its Applications, Allied Publisher Limited, New Delhi ,1991.

ELECTIVE COURSE – III

OPTIMIZATION TECHNIQUES

Objectives:

1. To enlighten the students in the field of operations research this has many applications in management techniques.
2. To help the students to find optimum solution in business management problems.

UNIT I :
Integer Programming.

UNIT II :
Dynamic (multistage) programming.

UNIT III :
Decision Analysis – Games and strategies.

UNIT IV:
Inventory Control.

UNIT V:
Non-linear Programming

TEXT BOOK:

[1] Operations Research by Kanit Swarup,P.K.Gupta and Manmohn. Ninth thoroughly Revised Edition.

UNIT I : Chapter 7
UNIT II : Chapter 13
UNIT III : Chapter 16 and 17(sections: 16.2-16.6&17.2-17.7)
UNIT IV : Chapter 19(sections:19.2-19.9)
UNIT V : Chapter 24(Sections:24.2-24.7)

REFERENCES:

[1] Hamdy A. Taha, Operations Research, Macmillan Publishing Company, 4th Edition.
[2] O.L. Mangasarian, Non Linear Programming, McGraw Hill, New York .
[3] Mokther S. Bazaraa and C.M. Shetty, Non Linear Programming, Theory and Algorithms, Willy New York .
[4] Prem Kumar Gupta and D.S. Hira, Operations Research-An Introduction, S. Chand and Co., Ltd., New Delhi.
[5] S.S. Rao, Optimization Theory and Applications, Wiley Eastern Limited, New Delhi.

ELECTIVE COURSE – IV

CLASSICAL DYNAMICS

Objectives:

1. To give a detailed knowledge about the mechanical system of particles.
2. To study the applications of Lagrange's equations and Hamilton's equations as well as the theory of Hamilton-Jacobi Theory.

UNIT – I :

Introductory concepts: The mechanical system – Generalized coordinates - constraints – Virtual work – Energy and momentum.

UNIT – II :

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

UNIT – III :

Special Applications of lagrange's Equations: Rayleigh's dissipation function – Impulsive motion – Gyroscopic systems – Velocity dependent potentials.

UNIT – IV :

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

UNIT – V :

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

TEXT BOOK:

[1] Donald T.Greenwood , Classical Dynamics, PHI pvt Ltd New Delhi -1985.

UNIT - I : Chapter 1 (sections 1.1 to1.5)
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)

REFERENCE (S)

[1] H.Goldstein, Classical Mechanics, (2nd Editions), Narosa Publishing House, New Delhi.
[2] Narayan ChandraRana and Promod sharad Chandra Joag, Classical Mechanics ,Tata McGraw Hill, 1991.

ELECTIVE COURSE – V
THEORY OF COMPUTATION

Objectives:

1. To provide an insight to theoretical computer science.
2. To get across to the students the notion of effective computability, using mathematical models.

UNIT – I :

Finite State Automata: Introduction – Finite State Machine – Deterministic Finite Automata – Transition System –Acceptability of a String by Finite Automata – Non Deterministic Finite Automata – Difference between DFA and NFA– Equivalence of DFA and NFA – Finite Automata with $\in$-moves – Two way Finite Automata – Finite Automata with Outputs.

UNIT – II :

Grammar and Chomsky Classification: Introduction – Grammar – Chomsky Classification – Languages and their Relations.

UNIT – III :

Regular Languages and Expression: Introduction – Regular Languages – Regular Expressions – Finite Automata and Regular Expressions – Pumping Lemma –Regular Sets and Regular Grammar.

UNIT – IV :

Context Free Languages: Introduction – Context free Grammar – Context free Languages – Simplification of Context free Grammars – Normal forms – Pumping Lemma for Context free Languages – Closure properties of Context free Languages.

UNIT – V :

Pushdown Automata and Turing Machine: Introduction- Pushdown Automata – Working Principle of Pushdown Automata – Turing Machine Model – Instantaneous Description – Representation of Turing Machines – Acceptance of Language by Turing Machine.

TEXT BOOK

[1] D. P. Achariya , Theory of Computation, MJP Publishers, 2010

UNIT I : Chapter 2 (Sections 2.0 to 2.10)
UNIT II : Chapter 3 (Sections 3.0 to 3.3)
UNIT III : Chapter 4 (Sections 4.0 to 4.5)
UNITIV : Chapter 5 (Sections 5.0 to 5.6)
UNIT V : Chapter 6 (Sections 6.0to 6.2) and Chapter 7(Sections7.0to 7.4)

REFERENCES:

1. C. L. Liu, Elements of Discrete mathematics, Mcgraw Hill, International Editions, 2000.
2. A.M. Natarajan, A. Tamilarasi and P. Balasubramanian, Theory of Automata and Formal Languages, New Age International (P) Limited Publishers, New Delhi.

ELECTIVE COURSE –VI
PURE GEOMETRY

Objective:

1. Generalizing theorems or mathematical structures can lead to deeper understanding of the original theorems or structures

UNIT– I:

Harmonic Ranges and Pencils – Theorem 1 to 5 and Examples

Page No: 1 – 8

UNIT –II:

Harmonic Ranges and Pencils – Theorems 6 to 10 and Examples

Page No: 8 –15.

UNIT– III:

Properties of Circles – Theorems 1 to 5 and Examples.

Page No: 18 – 24

UNIT– IV:

Properties of Circles – Theorems 6 to 11 and Examples.

Page No: 24 – 35

UNIT– V:

Properties of Circles – Coaxial Circles

Page No: 35 – 44

TEXT BOOK :

[1] S. Narayanan, R. Anumantha Rao, K.Seetharaman and K.S. Ramachandran Classical And Modern Geometry ; S. Chand and Company Ltd.; Ram Nagar New Delhi (1979).

ELECTIVE COURSE – VII

APPLIED CRYPTOGRAPHY

Objectives:

1. Communications professionals can use cryptography.
2. To shows how they can be used to solve security problems.

UNIT – I :

Data encryption standard (DES) – key schedule – Enciperment – Deciperment – S-Box Analysis and Design – Intersymbol dependencies.

UNIT – II :

Stream cipher System – Synchronous stream ciphers – Self – Synchronization ciphers – Error propagation – Non linear combination of LFSR sequences.

UNIT – III :

Public key cryptosystem – Merkle – Hellman knapsack cryptosystem – RSA Cryptosystem – RSA authentication scheme – Melliece's Algebraic codes cryptosystem.

UNIT – IV:

Bose – Chanudhuri – Hocquenghem codes – Expression of Cyclic codes – BCH code Structure and encoding – Syndrome computation – BCH decoding – Direct solution Method by Peterson, Gorenstein and ziereer – Direct coding by chien's method – BCH Decoding by Berlekamp Algorithm by symmetrical syndrome matrix – straight forward approach for BCH decoding .

UNIT – V:

Galois field adder – Combinational logic multipliers – Sequential logic multipliers – Cellular Array multiplier – Circuits for squares and square roots – Division circuits Over GF (2^m) arithmetic based on exponent representation – GF(2^m) – Arithmetic based on Normal basis.

TEXT BOOK :

[1] Man Young Rhee – Cryptography and secure communication– McGraw Hill , Book Co. Singapore (1994)

ELECTIVE COURSE-(VIII)
FLUID DYNAMICS

Objectives:

1.To give the students an introduction to the behaviour of fluids in motion.

2.To give the students a feel of the applications of Complex Analysis in the analysis of flow of fluids.

UNIT-I:

Real Fluids and Ideal fluids – Velocity of a Fluid at a point – Streamlines and path lines; steady and Unsteady Flows – The velocity potential – The Vorticity vector – Local and Particle Rates of Change - The Equation of continuity – Worked examples- Acceleration of a Fluid – 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 Equations of motions – Bernoulli's equation – Worked examples.

UNIT-II:

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: Strokes stream function.

UNIT-III:

Some Two-Dimensional Flows: Meaning of a Two-Dimensional Flow – Use of cylindrical Polar Coordinates – 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:

The use of Conformal Transformation and Hydrodynamical Aspects – Stress components in a Real Fluid – Relations between Cartesian components of stress – Translational Motion of Fluid Element – The Rate of Strain Quadric and Principal Stresses – 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:

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:

[1] F.Chorlton,FluidDynamics,CBS publishers&Distributors,NewDelhi, 1985.

UNIT I : Chapter 2 (Sections 2.1 to 2.9), and Chapter 3 (Sections 3.2 to 3.6)

UNIT II : Chapter3(Sections 3.9to3.11) and Chapter4 (Sections 4.1,4.2,4.3 and 4.5)

UNIT III : Chapter 5 (Sections 5.1 to 5.9) (omit 5.7)

UNIT IV : Chapter 5 (Section 5.10), and Chapter 8 (Sections 8.1 to 8.9)

UNIT V : Chapter 8 (Sections 8.10 to 8.16)

REFRERNCES:

[1] J.D.Anderson,ComputationalFluid Dynamics,The Basics with Applications, McGraw Hill, 1995.

[2]R.K.Rathy,AnIntroduction to Fluid Dynamics, Oxford and IBG Publishing Co., New Delhi, 1976.

[3]S.W.Yuan, Foundations of Fluid Mechanics, Prentice Hall of India Pvt Ltd.,NewDelhi,1976..

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