1. ALGEBRA

Unit – I COUNTING PRINCIPLE

Another counting principle - class equation for finitegroups and its applications - Sylow's theorems (For theorem2.12.1, First proof only).- Solvable groups - Direct products - Finite abelian groups- Modules.

Chapter 2 : Sections 2.11 and 2.12 (Omit Lemma 2.12.5),2.13 and 2.14 (Theorem 2.14.1 only)
Chapter 4: Section 4.5
Chapter 5: Section 5.7 (Lemma 5.7.1, Lemma 5.7.2,Theorem 5.7.1)

Unit – II LINEAR TRANSFORMATIONS

Canonical forms –Triangularform - Nilpotent transformations. Jordan form – rational canonical form.

Chapter 6: Sections 6.4 , 6.5, 6.6 and 6.7

Unit – III TRACE AND TRANSPOSE

Trace and transpose - Hermitian, unitary, normal transformations, real quadratic form - Extension fields –Transcendence of e.

Chapter 5: Section 5.1 and 5.2
Chapter 6: Sections 6.8, 6.10 and 6.11 (Omit 6.9)

Unit – IV ROOTS OR POLYNOMIALS

Roots or Polynomials-More about roots – Elements of Galois theory.

Chapter 5: Sections 5.3, 5.5 and 5.6

Unit – V FIELDS

Finite fields - Wedderburn's theorem on finite division rings- Solvability by radicals - A theorem of Frobenius - Integral Quaternions and the Four - Square theorem.

Chapter 5: Section 5.7 (omit Lemma 5.7.1, Lemma 5.7.2 and Theorem 5.7.1)
Chapter 7: Sections 7.1 , 7.2 (Theorem 7.2.1 only), 7.3 and 7.4

Text Book:

I.N. Herstein. *Topics in Algebra* (II Edition) Wiley Eastern Limited, New Delhi, 1975.

Books for Supplementary Reading and Reference

1. M.Artin, *Algebra*, Prentice Hall of India, 1991.

2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, *Basic Abstract Algebra* (II Edition) Cambridge University Press, 1997. (Indian Edition)

3. I.S.Luther and I.B.S.Passi, *Algebra*, Vol. I – Groups(1996); Vol. II Rings, Narosa Publishing House, New Delhi, 1999

4. D.S.Malik, J.N. Mordeson and M.K.Sen, *Fundamental of Abstract Algebra*, McGraw Hill (International Edition), New York. 1997.

5. N.Jacobson, *Basic Algebra*, Vol. I & II W.H.Freeman (1980); also published by Hindustan Publishing Company, New Delhi.

2. MODERN ALGEBRA

Unit I GROUP THEORY
A counting principle – Normal Subgroups and Quotient groups – Homomorphism – Cayley's theorem – Permutation groups – Another counting principle – Sylow's theorems.

Unit II RING THEORY
Homomorphism of rings – Ideals and quotient rings – More ideals and quotient rings – Polynomial rings – Polynomials over the rational field – polynomials over commutative rings.

Unit III MODULUS
Inner Product Spaces – Orthogonal complement – Orthogonal Basis – Left Module over a Ring – Sub module – Quotient Module – Cyclic Module – Structure theorem for finitely generated Modules over Euclidean Rings.

Unit IV FIELDS
Extension fields – Roots of Polynomials – More about roots – The elements of Galois theory – Finite fields.

Unit V TRANSFORMATIONS
Triangular form – Hermitian, Unitary and Normal transformations.

Text Book
1. I.N. Herstein, *Topics in Algebra*, Second Edn, Wiley Eastern Limited.
UNIT – I - Chaper II : Sec 2.5, 2.6, 2.7, 2.10, 2.11, 2.12
UNIT – II - Chapter III : Sec 3.3, 3.4, 3.5, 3.9, 3.10, 3.11
UNIT – III- Chapter IV : Sec 4.1, 4.2, 4.3, 4.4, 4.5
UNIT – IV- Chapter V : Sec 5.1, 5.3, 5.5, 5.6 and Chapter VII: Sec 7.1
UNIT – V - Chapter VI : Sec 6.4, 6.5 and 6.10

Books for Supplementary Reading and Reference:
[1] Surjeet Singh, Qazi Zameeruddin, *Modern Algebra*, Vikas Publishing House Pvt Ltd.

[2] John, B. Fraleigh, *A First Course in Abstract Algebra*, Addison-Wesley Publishing company.

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

3. REAL ANALYSIS

Unit I : FUNCTIONS OF BOUNDED VARIATION

Introduction - Properties of monotonic functions -Functions of bounded variation - Total variation – Additive property of total variation - Total variation on [a, x] as a function of x - Functions of bounded variation expressed as the difference of two increasing functions - Continuous functions of bounded variation. Infinite Series : Absolute and conditional convergence - Dirichlet's test and Abel's test - Rearrangement of series - Riemann's theorem on conditionally convergent series. The Riemann - Stieltjes Integral - Introduction – Notation-The definition of the Riemann - Stieltjes integral – Linear Properties - Integration by parts- Change of variable in a Riemann - Stieltjes integral - Reduction to a Riemann Integral – Euler's summation formula - Monotonically increasing integrators, Upper and lower integrals - Additive and linearity properties of upper and lower integrals - Riemann's condition - Comparison theorems.

Chapter 6 : Sections 6.1 to 6.8 (Apostol)
Chapter 7 : Sections 7.1 to 7.14(Apostol)
Chapter 8 : Sections 8.8, 8.15, 8.17, 8.18(Apostol)

Unit II THE RIEMANN-STIELTJES INTEGRAL

Integrators of bounded variation-Sufficient conditions for the existence of Riemann-Stieltjes integrals-Necessary conditions for the existence of Riemann-Stieltjes integrals- Mean value theorems for Riemann - Stieltjes integrals - The integrals as a function of the interval - Second fundamental theorem of integral calculus-Change of variable in a Riemann integral-Second Mean Value Theorem for Riemann integral-Riemann- Stieltjes integrals depending on a parameter-Differentiation under the integral sign-Lebesgue criteriaon for the existence of Riemann integrals.

Infinite Series and infinite Products

Double sequences - Double series - Rearrangement theorem for double series - A sufficient condition for equality of iterated series - Multiplication of series - Cesaro summability – Infinite products.

Chapter 8 : Sections 8.20, 8.21 to 8.26

Power series

Multiplication of power series – The Taylor's series generated by a function - Bernstein's theorem - Abel's limit theorem - Tauber's theorem.

Chapter 7 : Sections 7.18 to 7.26(Apostol)
Chapter 9 : Sections 9.14 9.15, 9.19, 9.20, 9.22, 9.23(Apostol)

Unit III SEQUENCES OF FUNCTIONS

Pointwise convergence of sequences of functions - Examples of sequences of real - valued functions - Definition of uniform convergence – Uniform convergence and continuity - The Cauchy condition for uniform convergence - Uniform convergence of infinite series of functions - Uniform convergence and Riemann – Stieltjes integration - Uniform convergence and differentiation - Sufficient condition for uniform convergence of a series - Mean convergence.

Fourier Series and Fourier Integrals

Introduction - Orthogonal system of functions - The theorem on best approximation - The Fourier series of a function relative to an orthonormal system - Properties of Fourier Coefficients - The Riesz-Fischer Thorem - The convergence and representation problems in for trigonometric series – The Riemann - Lebesgue Lemma - The Dirichlet Integrals – An integral representation for the partial sums of Fourier series - Riemann's localization theorem

- Sufficient conditions for convergence of a Fourier series at a particular point – Cesaro summability of Fourier series- Consequences of Fejes's theorem - The Weierstrass approximation theorem.

Chapter 9 : Sections 9.1 to 9.6, 9.8, 9.10,9.11, 9.13(Apostol)

Chapter 11 : Sections 11.1 to 11.15 (Apostol)

Unit IV MEASURE ON THE REAL LINE

Lebesgue Outer Measure - Measurable sets - Regularity - Measurable Functions – Borel and Lebesgue Measurability

Integration of Functions of a Real variable

Integration of Non- negative functions - The General Integral - Riemann and Lebesgue Integrals

Chapter 2 Sec 2.1 to 2.5 (de Barra)

Chapter 3 Sec 3.1,3.2 and 3.4 (de Barra)

Unit V MULTIVARIABLE DIFFERENTIAL CALCULUS

Introduction - The Directional derivative - Directional derivative and continuity - The total derivative - The total derivative expressed in terms of partial derivatives - The matrix of linear function - The Jacobian matrix - The chain rule - Matrix form of chain rule - The mean - value theorem for differentiable functions - A sufficient condition for differentiability – A sufficient condition for equality of mixed partial derivatives - Taylor's theorem for functions of Rn to R1

Implicit Functions and Extremum Problems

Functions with non-zero Jacobian determinants – The inverse function theorem-The Implicit function theorem- Extrema of real valued functions of severable variables- Extremum problems with side conditions.

Chapter 12 : Section 12.1 to 12.14 (Apostol)

Chapter 13 : Sections 13.1 to 13.7 (Apostol)

Text Book:

1. Tom M.Apostol : *Mathematical Analysis*, 2nd Edition,Addison-Wesley Publishing Company Inc. New York, 1974.(UNITS –I, II, III and V)

2. G. de Barra, *Measure Theory and Integration*, Wiley Eastern Ltd., New Delhi, 1981. (UNIT IV)

Books for Supplementary Reading and Reference:

1. Bartle, R.G. *Real Analysis*, John Wiley and Sons Inc.,1976.

2. Rudin,W. *Principles of Mathematical Analysis*, 3rd Edition.McGraw Hill Company, New York, 1976.

3. Malik,S.C. and Savita Arora,*Mathematical Analysis*, Wiley Eastern Limited.New Delhi, 1991.

4. Sanjay Arora and Bansi Lal, *Introduction to Real Analysis*, Satya Prakashan, New Delhi, 1991.

5. Gelbaum, B.R. and J. Olmsted, *Counter Examples in Analysis*, Holden day, San Francisco, 1964.

6. Burkill,J.C. *The Lebesgue Integral*, Cambridge University Press, 1951.

7. Munroe,M.E. *Measure and Integration*. Addison-Wesley, Mass.1971.

8. Roydon,H.L.*Real Analysis*, Macmillan Publishing Company, New York,1988.

9. Rudin, W. *Principles of Mathematical Analysis*, McGraw Hill Company, New York,1979.

4. DIFFERENTIAL EQUATIONS

Unit I LINEAR DIFFERENTIAL EQUATIONS

Legendre polynomials – Legendre's equation and its solution – Legendre polynomial of degree n – generating function for Legendre polynomials – Orthogonal properties of Legendre's polynomials.

Unit II POLYNOMIAL OF ORDER n

Bessel's equations and its solution – Bessel's function of the first kind of order n- List of important results of Gamma and Beta functions – Hermite equation and its solution Hermite polynomial of order n – Orthoganal properties of the Hermite polynomials.

Unit III SPECIAL EQUATIONS

Hyperbolic function, General hyperbolic function – Hypogeomentric equation –Solution of hypogeomentric equations – Gauss Theore- Vandermonde's Theorem – Kummer's Theorem.

Unit IV LINEAR PARTIAL DIFFERENTIAL EQUATIONS OF ORDER ONE

Linear partial differential equations of order one – Lagrange's equations – Lagrange's method of solving Pp + Qq = R –Type based on rule I – Rule II – Rule III – Rule for solving (dx) / P = (dy) / Q = (dz) / R – solved examples.

Unit V NON LINEAR PARTIAL DIFFERENTIAL EQUATIONS OF ORDER ONE

Complex integral – Partial integral, Singular integral- Compatible system of first order equations – Charpit's method of characteristic for solving non linear partial differential equations

Text Book:

1. *Advanced Differential Equations*. MD.Raisinghanaia, S.Scand publication, New Delhi.

Books for Supplementary Reading and Reference:

1. *Ordinary Differential Equations,* S.G. Deo Lakshmikanthan, V. Raghavendra II edition.

2. *Elements of Partial Differential Equation*, Ian N. Snedden, McGraw Hill International Student Edition.

3. *Differential Equations and Stability Theory*, Deo and Raghavendra, Tata McGraw Hill Edition.

5. NUMBER THEORY

Unit I THE FUNDAMENTAL THEOREM OF ARITHMETIC

Introduction – Divisibility – Greatest Common Divisor – Prime Numbers – the Funtamental theorem of arithmetic – the serious of reciprocals of the primes – The Euclidean algorithm- The greatest cmmon divisor of more than two numbers.

Unit II ARITHMETICAL FUNCTIONS AND DIRICHLET PRODUCT

Introduction – The Möbius function – The Euler totient function – A relation connecting Möbius function and Euler totient function – The product formula for Euler totient function – The Dirichlet product of Arthimetical function- Dirichlet Inverse and Möbius Inverse – The Mangoldt function.

Unit III MULTIPLICATIVE FUNCTION , DIRICHLET MULTIPLICATION AND THE DIVISOR FUNCTION

Multiplicative function - Multiplicative function and Dirichlet Multiplication – The inverse of a completely multicative function – Liouville's function – The divisor function – Generalized convolutions – Formal Power series.

Unit IV AVERAGES OF ARITHMETICAL FUNCTIONS

Introduction – The big oh notation,Asymptotic equality of function – Euler's summation formula – Some elementary asymptotic formulas –The average order of d(n)- The average order of the divisor functions $\sigma_\alpha(n)$ - The average order of $\varphi(n)$ - The average order of $\mu(n)$ and $\Lambda(n)$- The partial sums of a Dirichlet product.

Unit V CONGRUENCES AND PRIMITIVE ROOTS

Definition and basic properties of cngruences – Residues classes and complete residue systems – Linear congruences – Reduced residue systems and the Euler - The exponent of a number mod m.Primitive roots – Primitive and reduced residue systems – the nonexistence of primitive roots mod 2^α for $\alpha \geq 3$ - the existence of primitive roots mod p for odd primes p – Primitive roots and quardratic residues.

Text Book:

1. Tom M. Apostol, *Introduction to Analytic Number Theory*, Narosa Publishing House.

Books for Reading and Reference:

2. Neville Robbins, *Beginners Number Theory*, Narosa Publication, 2007
3. S.B.MAlik, *Basic Number Theory*,Vikas Publishing Pvt Ltd.
4. Geroge E. Andrews, *Number Theroy*, Hindustan Publishing Coorparation, 1984.

6.TOPOLOGY

Unit I TOPOLOGICAL SPACES AND CONTINUOUS FUNCTION

Topological spaces – Basses for Topology – Subspace Topology – Closed sets and limit points- continuous functions – The metric Topology – The quotient Topology.

Connectedness and compactness:Connected subspace of the real line – Compact spaces – Compact subspaces of the real line

Unit II COUNTABILITY AND SEPARATION AXIOMS

The countability axioms – The separation axioms – Normal spaces _ The Urysohn lemma – The Urysohn metrization Theorems – The Tychonoff Theorem.

Unit III THE FUNDAMENTAL GROUP

Homotopy of paths - The fundamental group- Covering spaces – The fundamental Theorem of Algebra – The fundamental group of S^n.

Unit IV SEPARATION THEOREM IN THE PLANE

The Jordan separation Theorem – The Jordan curve Theorem – Imbedding graphs in the plane – The winding number of a simple closed curve – The Cauchy Integral formula.

Unit V CLASSIFICATION OF SURFACE

Fundamental group of surfaces – Homology of surfaces – Cutting and pasting – The classification Theorem – Constructing compact surface.

Text Book

1. *Topology*, James R. Munkers, Second Edition, Prentice Hall of India Private Limited, New Delhi.

Books for Supplementary Reading and Reference:

1. *Introduction to Topology and Modern Analysis*, G. F. Simmons, Tata Mcgraw Hill publications.

2. Algebric *Topology on Introduction*, W.S. Massey, Springer overlay, Newyork, 1976.

7.GRAPH THEORY

Unit I GRAPHS , SUBGRAPHS , TREES AND CONNECTIVITY
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 - Coonectivity – Blocks.

Unit II MATCHINGS , INDEPENDENT SETS AND CLIQUES
Matchings – Matchings and Coverings in Bipartite Graph- Perfect Matchngs –Independent Sets – Ramsey's Thorem.

Unit III EDGE COLOURINGS AND VERTEX COLOURINGS
Edges Chromatic Number – Vizing's Theorm – the Timetabling Problem – Chromatic Number – Brooks' Theorem – Hajos' Conjecture – Chromatic Polynomials – Girth and Chromatic Number.

Unit IV DIRECTED GRAPHS
Directed Graphs – Directed Paths – Directed Cycles – A job Seqencing Problem – Designing an Efficient Compute Drum- Making a Road System One- Way – Ranking the Participants in a Tournament.

Unit V LABELINGS AND DOMINATION
Predecessor and Successor – Graceful Labeling – Sequential Functions – Magic Graphs – Domination Number – Minimal Dominating set – Independent Dominating set – Bunds for the Dominating Number – Global Dominating set- Total Domination – Connected Domination.

Books for Reading and Reference:

1. J.A. Bondy and U.S.R.Murty, *Graph Theory with Applications*, North- Holland, 1976. (Unit I to Unit IV)
2. Dr.M.Murugan, *Graph Theory and Algorithms*, Muthali Publishing House,Anna Nager, Chennai
(Unit V)
3. P. J. Cameron and J. H. Van Lint Designs, *Graphs, Codes and their links*, London Math.Soc., Students Text No. 22, Cambridge Univ. Press, 1991.

4. B. Bollobas *Random graphs*, Acad. press.

8.NUMERICAL METHODS

Unit I TRANSCENDAL AND POLYNOMIAL EQUATIONS

Bisection Method – Iteration Methods Based on First Degree Equation - Iteration Methods Based on Second Degree Equation- Methods for Complex Roots –Polynomial Eqations.

Unit II SYSTEM OF LINEAR ALGEBRIC EQUATIONS AND EIGENVALUE PROBLEMS

Direct Methods- Error Analysis – Iteration Methods – Eigenvalues and Eigenvectors

Unit III INTERPOLATION AND APPROXIMATION

Introduction – Lagrange and Newton Interpolations – Finite Difference Operators – Interpolating Polynomials using finite Difference – Hermite Interploations – Piecewise and spline interpolation – Bivarite Interpolation

Unit IV DIFFERENTATION AND INTEGRATION

Numerical Differentation – Extrapolation Methods – Partial Differentation – Numerical Integration – Methods based on Interpolation – ethos based on undetermined coefficients – Composite integration methods- Duble Integration

Unit V ORDINARY DIFFERENTIAL EQUATIONS

Numerical Methods – Singlestep Methods – Multistep Methods – Modified predictor – corrector method

Books for Reading and Reference:

1. M.K.Jain, S.R.K Iyengar,R.K Jain: *Numerical Methods for Scientific and Engineering Computation*,New Age International (p) Ltd, 3rd Edition.
2. Sastry, *Introductory Methods of Numerical Analysis*
3. P.Kandasamy, K Thilagavathy, k Gunavathi, *Numerical Methods*

9.STOCHASTIC PROCESS

Unit I LIMIT THEOREMS

Probability spaces, random variables, independence- Kolmogorov's 0-1 law, Borel-Cantelli lemma- Integration, Expectation, Variance- Results from real Analysis- Some inequalities- The weak law of large numbers – The probability distribution function – Convergence of random variables – The strong law of large numbers

Unit II THE CENTRAL LIMIT THEOREM

The Birkhoff ergodic theorem – More convergence results – Classes of random variables- Weak convergence -The central limit theorem – Entropy of distributions – Markov operators – Characteristic function – The law of the iterated logarithm -

Unit III DISCRETE STOCHASTIC PROCESS

Conditional Expectation – Martingales – Doob's convergence – Levy's upward and downward theorems – Doob's decomposition of a stochastic process – Random walks – The random walk on the free group – Markov process

Unit IV CONTINUOUS STOCHASTIC PROCESS

Brownian motion – Some properties of Brownian motion – The Wiener measure – Levy's modulus of continuity – Stopping Times – Continuous time martingales – Doob inequalities – Self-intersection of Brownian motion – Recurrence of Brownian motion – Neighborhood of Brownian motion

Unit V SELECTED TOPICS

Percolation – Random Jacobi matrices – Estimation theory – Multidimensional distribution – Poisson processes –Random maps - Circular random variables –Arithmetic random variables.

Books for Reading and Reference:

1. Oliver Knill, *Probability and Stochastic Processes with Applications*, Overseas Press, 2009
2. A.K.Basu ,*Introduction to Stochastic Process,*Narosa Publishing House, Second Reprint 2007.
3. J.Medhi ,*Stochastic Process*, New Age International Publisher, 2nd edn.
4. Samuel Karlin and Howard M.Taylor, *A First Course in Stochastic process*,2nd edn., Academic press.1975

10.DIGITAL TOPOLOGY

Unit I THE DIGITAL PLANE

Introduction, Motivation and Scope, Historical Remarks, Basic Definitions: Digital Topology, Connectedness in 2-D, 3-D, Jordan’s Curve Theorem, Digital Jordan Theorem, The graphs of 4- and 8-topologies.

Unit II EMBEDDING THE DIGITAL PLANE

Line Complexes : Theorems on Line Complexes with proof, Eulers Theorem on Line Complexes. Cellular Topology: Definition, Closed Models, Open Models, Theorems on open and closed models.

Unit III AXIOMATIC DIGITAL TOPOLOGY

Definition and Simple Properties of Digital Topology, Definition of Alexandroff Spaces, Connectedness and Related Theorems in Alexandroff Spaces, Alexandroff Topologies for the Digital Plane: Examples and Graphs.

Unit IV SEMI-TOPOLOGY

Definitions, Homeomorphic Spaces and Examples, The Associated Topological Spaces and Examples, Theorems, Classifications, Related Concepts, Theorems, Connectedness, Ordered Sets.

UNIT V APPLICATIONS TO IMAGE PROCESSING

Models for Discretization, Continuity, Homotopy, Fuzzy Topology.

Text Books:

1. *Concepts of Digital Topology* By T.Y.Kong A.W Roscue and A.Rosenfield

2. *Digital Topology; Introduction and survey* By T.Y.Kong and A.Rosenfield

11.FORMAL LANGUAGE AND AUTOMATA

Unit I THREE BASIC CONCEPTS

Languages – Grammars – Automata deterministic finite accepters – Deterministic finite accepters - Deterministic accepters and Transition groups – Languages and deterministic finite automata – Regular Languages, non deterministic finite accepters, equivalence of NFA and DFA reduction of the number of states in finite automata.

Unit II REGULAR EXPRESSION

Definitions – Languages associated with regular expressions , connection between regular expressions and regular Languages- Regular expressions denote regular Languages - Regular expressions for regular Languages, Regular, Regular grammars : Right and left, Linear grammars, Right linear grammars, generate regular Languages – Right linear Grammars for Regular Languages –Equivalence of regular Languages and Regular Grammars.

Unit III PROPERTIES OF REGULAR LANGUAGE

Closure properties of regular Languages: Closure under simplest operations –Closure under other operations , identifying non-regular Languages using the Pigeonhole Principle – A pumping Lemma – Context free Grammars : examples left most and rightmost derivations – Derivation trees – Relation between sentential forms and derivation forms. Parting and Ambiguity : Parting and membership – Ambiguity in Grammars and Languages.

Unit IV METHODS FOR TRANSFORMATION GRAMMAR

A useful substitution rule – removing useless production – Removing Lamda productions – Removing unit productions, Two important normal form : Chomsky Normal forms – Greibach Normal forms – Properties of context free Languages : A Pumping Lemma for context free Languages – A pumping Lemma for linear Languages.

Unit V FUZZY GRAMMARS

Fuzzy subset – Fuzzy Languages _ Types of Grammars – Fuzzy context free Grammars – Context free Max PCFG Grammars - Context free fuzzy Languages.

Text Book

1. *An introduction to formal Languages and Automata*, Peter Linz 5th edition.

Unit I : Chapter 1 : 1.2, Chapter 2.

Unit II : Chapter 3.

Unit III : Chapter 4: 4.1 and 4.3. and Chapter : 5.1 and 5.2.

Unit IV : Chapter 6 : 6.1 and 6.2 and Chapter 8 : 8.1.

2. *Fuzzy Automata and Language Theory and Applications*, John. N. Mordeson and Revender S. Malik Crc pree company.

Unit IV : Chapter 1 : Section 1.4 and Chapter 4. Section 4.1 -4.4.

12.FUZZY GRAPH THEORY

Unit I FUZZY SETS AND FUZZY RELATIONS

Introduction - Fuzzy sets and Fuzzy sets operators – Fuzzy relations – Compostion of Fuzzy relations – Properties of Fuzzy relations

Unit II FUZZY GRAPH

Introduction to fuzzy graph – Operations of fuzzy graphs – Paths and connectedness

Unit III FUZZY TREE AND FUZZY FOREST

Fuzzy Bridge and Fuzzy Cut Nodes – Fuzzy Forest and Fuzzy Trees – Geodesics – Triangle and Parallelogram laws

Unit IV FUZZY BIPARTITE GRAPHS

Fuzzy Independent set and Fuzzy Bipartite graph – Fuzzy Bipartite Part and Maximal Bipartite Part – Maximal Fuzzy Bipartite Part Algorithm – Domiating Set

Unit V DOMINATION IN FUZZY GRAPHS

Fuzzy Independent set – Bounds – More Adjacency in Fuzzy graph – Automorphism of fuzzy graphs – Regular fuzzy graph

Books for Reading and Reference:

1. A.Nagoorgani , V.T. Chanrasekaran: *A First Look at Fuzzy Graph Theory*, Allied Publishers Pvt. Ltd.2010

2. John N.Morderson, *Fuzzy Graph and Fuzzy Hypergraph*, Premchand S.Nair, Physica
   – Verlag, A Springer ,2000

ALGEBRIC GRAPH THEORY

L!nit I Eigenvalues of Graphs(Michael Doob):
Introduction- examples -- iratri x theory-eigenvalues and walls- eigenvalues and labelling of graphs Lower bounds for the eigenvalues- Upper bounds for the eigenvalues-Matrics related graphs- cospectra! graphs.

Unit II Gina phs and Matrices(Richard A B rualdi and Bryan L. Shader):
Introduction-classical theorems — Digraphs — B iclique partitions of graphs-B iparti[e graphs permanents-C hordal graphs and perfect Gaussian elirn ination.

Unit III Spectral graph Theory(Dragos Cvetkovic and Peter Row linson)
Introduction — angles — star sets and star partition — star complements— exceptional graphs- Non- coiplete extended p-suns of graphs- integral graphs.

Unit IY Graph **Laplacian(Bojan** Zohar)
Introduction —The Laplacian of a graph — Laplace eigenvalues — EigelJ Values and vci tex partition of giaphs -The max — cul pi oblem and semi-definite pi ogramming — Isopei-imetric inequalities The traveling salesman pi oblem — Random walks on graphs.

Unit V Automorphisms of graphs(Peter J Cameron)
Graphs A utomorphisms — A utoirorphisms of typical graphs- permutation gtaphs —Permutation groups — Abstract groups — Cayley graphs —vertex-transitive graphs —H i giver Symmetry — Infinite graph-s- graph lsomorph isnas.

Boolts for Reading and Reference:

1. Lowell W. Beinelke and Robin .I. W i lson, Topices in A lgebraic Graph Theory, Cambridge University Prcss, 2007
2. Rob Beezel, An Introduction to A I gebraic Graph Theory, Pacific Univei sity, 2009

INVENTORY MANA GEMENT
AND CONTR OL.

Unit 1: Detertniii istie lot size models and their extensions

lnt‹‘oduction the simplest lot size model — Mo stock outs — Additional properties or the ›model, An example — A ccountin g for integml its of demand Case wile› o hqci<cat-der ui e pe ’m i that The lost sales case. The case ot a finite production rate -— Cuilsti‘ai Its — Constraints; An example Pei‘iodic i‘e ic\v toi’m ulatiun — Brian tits discounts — “All units” discounts — lncl°emental quani ity discounts.

Unit 2: P roba bility theory and stochastic processes

lnti oduction — Basic laws of probabi lities - Dlscrete random variables — Continuous random variables — Expected vat ues Time averages and Ensemble averages I*robabi I istic description of demands — I oint distribui ions — Con solutions — Marl‹ov processes discrete in space and time — Marl‹ov processes d iscrete in space and continuous in time — Other types of Marf‹ov processes Properties or’ the Poisson di stribrition — The normal distribution — Properties ot the normal distributican.

Unit 3: Lot size-reorder point models with stochastic demands

Introduction — Henri istic approx itnate treatment of the backorders case — Heuristic approx imate treatment for the lost sales case — discuss ion of the simple models and a numerical example — Exact formulas for the backorders case with Poisson demands and constant procui ement lead time — An important special case — The normal approximation — A n example in solving the use of the exact form ot *K*.

Unit 4: Periodic review models with stochastic demands

Introduction - Simple, Appropriate *R, T*> models — The exact formtilation tit the <n/, r, model for the bacl‹oi-ders case with Poisson demands and constant lead times — A pptox iiaiate four o1 time *nQ,r, I*^- model fcr large Q - The <n{j, r,model tor normal I y d istributed demands — Exact equations for -fi, models.— The <*Q,r*-^ model as the limit as T — fi of the <n , r, rnodeL

Unit 5: Single period m odels

Introduction "The general s ingle period model with ti me independent costs-Examples — Constrained mu ltiple item probhems — Sin gle period models with time dependent costs Marginal anal ysis.

Boolts for Reading and Reference:

1. G. Hadley (University of Chicago), 7. M. Wh it in, Anal ysis of Inventory Systems, (Univei-sity of Cat i forn ia, Bet keley), Prentice-Hal 1, 1963

FUZZY RELIABILITY THEORY

Unit I: Rel ial ility 4’lseory - lntrod uction- Str uct ure ftnactioias — M in imal path and Minimal cut Sets- Reliability of Systems of Independent Components.

Unit II: Bounds on the Reliability Function — Methods of Inclusion and Exclusion — Second Method for obtaining bounds of r(p) - Systems life as a Function of Component Lines — Expected System Life time- Systems with repair .

Unit III: Basic Concepts and Definitions of Fuzzy Sets- I ntuitionistic Fuzzy Sets - Extension principle for intriit ionistic fuzzy sets - Cartesian prod Pict of lntriitionistic Fuzzy sets Extension Principle in Cartesian Space - Fault Tt ee Analysis - Advantages of Fault Tree Anaiysis.

Unit IV: Trapezoidal Intuitionistic Fuzzy Number (TrlFN) Arithmetic oper- ations of intuitionistic fuzzy numbers based on Extension Principle - A rith metic operations of Intuitionistic fuzzy numbers based on (o, §)-cuts Method — Ptopei ties on Trl FN - Numerical Exposure OF Arithmetic Operation on Intuitio'ni stic Fuzzy N mr ber.

Unit V: Brian 8 ulat lntuitionisti c Fuzzy Number (TIFF) Chart of transformation rule on lntriitionistic Fuzzy N um ber - Arithmetic opei‘ations on Triangular 1 ntuitionistic k dizzy Number - Reliability Analysis of a Series and Parallel Network - lntuitionistic Fuzzy Equations and its application on Reliab i I ity

Evaluation. Text Books:

1. Introduction to Probability Mode1s, Slaeldon M. Ross, 10“‘ EN it ion, Elsevier, Academic Press. Unit I and Unit II
2. Kai-Yuan Cai, Introduction to fuzzy rel iability, K luwer Acad emic pu bl ishers(1996). Unit III
3. H.I.Zimmerirann, Fuzzy set theory and its appl ications, 2"d ed ition, K I uwer Academic pu b1isleers, Dordreclat, 1991 . Unit IV
4. Singer, D. (l 990) A ftizzy set approach to fault tree analysis, fuzzy sets and systems Unit V