Harcourt Butler Technical University

Department Mathematics, School of Basic and Applied Sciences

BMA-401, DISCRETE STRUCTURES
(MCA, I Semester)
(Effective from Session 2017-18)

L	T	P	C
3	1	0	4

UNIT I: Fundamentals of Logic

Propositional Logic: Propositions, Basic logic operations and truth tables, Tautologies, Contradictions, Contigency, Algebra of propositions, Logical equivalence: the laws of logic, Logical implication: Rules of inference, Logical analysis of arguments, Some computing applications (Normal forms), Functionally complete set of operations, Formal proofs.
First Order Logic: Predicates & quantifiers, Nested quantifiers, Use of quantifiers, Rules of inference, Validity of arguments.
Notion of Proofs: Proof by counter example, the contraposition, proof by contradiction, inductive proofs.

UNIT II: Set Theory, Relations and Functions

Set Theory: sets & subsets, Venn diagrams, Set operations and laws, countable and uncountable sets, Cartesian product, Cardinality, Principle of inclusion- exclusion.
Relations: Relation, Representation & properties, n-ray relations and applications, Composition of relations, Closures of relations, Equivalence relation & partitions, partial orders, compatibility relation.
Functions: Functions and its types, Inverse function, Composition of functions, Special functions, Recursively defined functions, Computational Complexity, Analysis of algorithms.
Theorem Proving Techniques: Mathematical induction, strong induction, and well ordering, structural induction, Pigeonhole principle.

UNIT III: Algebraic Structures and Coding Theory

Algebraic Structures: Definition, Properties, Semi group, Monoid, Group, Properties of groups, Subgroup, Cyclic group, Cosets and Lagrange's theorem, Permutation groups, Normal subgroup, Homomorphism and isomorphism of groups, Congruence relation, Rings and Fields. Example and standard results.
Coding Theory: Elements of coding theory, Hamming matric, Parity-check and generator matrices, Coding and error detection, Group codes: decoding with coset leaders and error correction, Hamming matrices.

UNIT IV: Partially Ordered Structures

Posets,: Definitions, ordered set, Hasse diagram, isomorphic ordered set, well ordered set, Minimal and Maximal elements, LUB & GLB etc.
Lattices: Definition & Properties, Product Lattices, Isomorphic Lattices, Applications, Types of Lattices.
Boolean Algebras: Definitions & Properties, SOP & POS forms, Logic gates and minimization of circuits, Karnaugh maps, Quine-McClusky method.
Trees: Definition & Examples and Properties , Rooted tree, Binary tree, Tree traversal, application in computer science and engineering .

UNIT V: Combinatorics and Graph Theory

Combinatorics: Basic counting techniques, Discrete numeric functions and properties, Recurrence relations and their applications (modelling), various methods of solutions, system of recurrence relations, OGF & EGF, properties, applications: solution of recurrence relations and combinatorial problems. Polya's enumeration theorem and applications.
Graphs: Graphs and graph models, terminology, matrices associated with graphs, Isomorphism, Special types of graphs, connectedness, Euler and Hamilton graphs with their applications, trees with properties, MST, planer graphs and applications, criteria of planarity, Graph coloring and coloring models, directed graphs.

Books Recommended:
1. Trembley, J.P. & R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw Hill.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw Hill.
3. Ralph, P. Garimaldi, "Discrete & Combinatorial Mathematics" Pearson Publication, Asia.
4. Deo, Narsingh,"Graph Theory with applications to Engineering & Computer Science", PHI.
5. Krishnamurthy, V., "Combinatorics Theory & Application", East-West Press Pvt. Ltd., New Delhi.

BMA-402, COMPUTER ORIENTED NUMERICAL AND STATISTICAL TECHNIQUES
(MCA, II Semester)
(Effective from Session 2017-18)

L	T	P	C
3	1	0	4

UNIT I: Nonlinear Equations and Simultaneous Linear Equations

Roots of nonlinear equation, Methods of solution, Order of convergence of iterative methods, Simple roots: Bisection, False positions, Secant, Newton-Raphson, Chebyshev, Iteration and multi point iteration methods, Multiple roots: Newton-Raphson and Chebyshev, Complex roots: Newton-Raphson and Muller's method, a system of nonlinear equations: Newton-Raphson and Iteration methods, Polynomial equations: Bairstow's method, convergence analysis of above methods.

Linear systems: Introduction, Direct methods, Operation count, Pivoting, III conditioned linear systems & condition number, Iteration methods: Jacobi, Gauss-Seidel, SOR methods, convergence conditions. Special system of equations: Thomas algorithm. Eigen value problems: Given's and power methods.

UNIT II: Interpolation, Differentiation and Integration

Curve fitting: Polynomial interpolation, error, Existence and Uniqueness, Truncation error bounds, difference operators, Newton forward and backward difference interpolations, Lagrange, Newton divided difference and Iterated Interpolations, Stirling and Bessel's interpolations, Spline interpolation, Error analysis.

Numerical Integration: Methods based on interpolations (Trapezoidal, Simpson's 1/3, Simpson's 3/8 rule), Gauss quadrature methods, Romberg integration, Error bounds and estimates.

UNIT III: Numerical Solution of Ordinary Differential Equations

Initial-value problems, Single step methods: Taylor's, picard's Euler's, Modified Euler's method and Runge – Kutta method (Fourth Order), Error estimates, Multi-step methods: Adam's-Bashforth and Milne's methods, convergence and stability analysis, Simultaneous and Higher order equations: RK Fourth order method.

UNIT- IV: Curve Fitting, Correlation, Regression and Probability

Curve-fitting, method of least- squares, fitting of straight lines, polynomials, non-linear and exponential curves etc., correlation analysis, linear, non-linear and multi-regression analysis, probability, random variables and probability distributions, expectation, moments and transform methods, Binomial, poisson and Normal distributions.

UNIT-V: Statistical Methods

Sampling theory, (small and large), parameter estimation, confidence intervals, tests of hypotheses and significance; Overview of t-distribution, F-distribution and χ^2-distribution, Z-, t-, F-, and χ^2 tests, goodness of fit test $-\chi^2$ test, analysis of variance, non-parametric tests (Simple application), time series analysis, index numbers, quality control charts.

Books Recommended:

1. M.K. Jain, S.R.K. Iyengar & R.K. Jain, Numerical method for Scientific and Engineering Computation, New age International Publication.
2. S.S. Sastry, Introductory Methods of Numerical Analysis, Eastern Economy Edition.
3. S. Rajasekaran, Numerical Method in Science and Engineering, Wheeler Publishing House.
4. B.S. Grewal, Numerical Method in Engineering & Science, Khanna Publishers.
5. D.L. Harnett, Statistical methods.
6. J.N. Kapur and H.C. Saxena, Mathematical Statistics, S. Chand. Co., 2001.
7. H.C. Saxena, Practical Mathematical Statistics, S. Chand & Co., 2000.