RAMAKRISHNA MISSION VIDYAMANDIRA

CBCS Syllabus B.Sc. Computer Science Honours

Semester-II

Course Code: CMSA CC 4 Credit: 6
Course Type: Core Course

Course Outcome:

i) Able to construct simple mathematical proofs and possess the ability to verify them.

ii) Be skilful in expressing mathematical properties formally via the formal language of propositional logic and predicate logic.

iii) Be able to specify and manipulate basic mathematical objects such as sets, functions, and relations and will also be able to verify simple mathematical properties that these objects possess.

iv) Be able to apply basic counting techniques to solve combinatorial problems.

v) Able to understand the basic concepts of graph theory.

vi) Use a combination of theoretical knowledge and independent mathematical thinking to solve some real-time problems.

vii) Write about graph theory in a coherent and technically accurate manner.

CMSA CC 4 T: Computational Mathematics

Credit: 4   **Marks: 50**

Introduction: Sets - finite and infinite sets, uncountable Infinite Sets; functions, relations, Properties of Binary Relations, Closure, Partial Ordering Relations; Equivalence Relation, Poset, Hasse Diagram; Functions; Introductory concepts of Group, Ring, Field.   [10 L]

Counting Theory: Pigeon Hole Principle (generalized statement, proof and standard applications to mathematical problems), Principle of Inclusion and Exclusion (generalized statement, proof and standard applications to mathematical problems), Permutations and Combinations (with and without repetition),   [10 L]

Recurrences: Recurrence Relations, generating functions, Linear Recurrence Relations with constant coefficients and their solution, Substitution Method, Recurrence Trees.   [8 L]

Introduction to Probability: Definition of sample space, events, probability, simple problems, Conditional Probability, Probability distribution – Binomial Distribution, Poison Distribution, Normal Distribution (Definition only), Random variable, expected value, Standard Deviations and Variance.   [12 L]

Introduction to Graph Theory: Definition of linear graph, self loop, Parallel edges, simple graph, multi graph, Pseudo graph, directed graph, Application of graph, Finite and Infinite graph, Incidence and degree, Indegree and Outdegree of directed graph and their relation, Isolated vertex, Pendant vertex and Null graph.   [6 L]

Walk, Path & Circuit: Isomorphic Graph, Subgraph (Edge and Vertex disjoint), Walk, path, circuit and their differences, Connected & Disconnected Graph, Components, Operation On Graphs (Union, Intersection, Ring sum, Decomposition, Deletion of edge and vertex, Fusion, Euler Graph, Arbitrarily Traceable Graph, Hamiltonian paths and circuit, Complete graph, Bipartite graph, complete bipartite graph. [5 L]

Tree: Definition of tree, Distance, Eccentricity, Center, Radius and diameter, rooted tree, Binary tree and its properties, Spanning tree. [3 L]

Planar Graph: Euler formula, Kuratowski's theorem. [3 L]

Cut Set & Cut Vertices: Cut set and its properties, All Cut-sets in a graph, Fundamental circuit and Cut set, Connectivity (Edge & Vertex), Separability. [3 L]

CMSA CC 4 P: Numerical Methods Laboratory

Credit: 2 **Marks: 25**

Laboratory based on following Numerical Methods theory using C. [40 L]

Errors: Approximate and Rounding of Numbers, Significant digits, Errors and their types, Propagation of errors.

Interpolation: Newton Forward and Backward interpolation, Lagrange interpolation.

Solving a Set of Linear Equations: Gaussian Elimination, Gauss–Jordan, Iteration methods and their convergence conditions, Gauss-Seidel, Gauss-Jacobi Iterative Methods.

Solving Non-linear equations: Bisection, Regula-falsi, Secant and Newton-Raphson, their order of convergence.

Solving Differential Equations: Euler, Runge-Kutta second and fourth order methods.

Numerical Integration: Trapezoidal and Simpson's $1/3_{rd}$ rules.

Curve fitting: Least square approximation, Linear regression, Polynomial regression, Fitting Exponential and Trigonometric functions.

Recommended Books:

1. Discrete Mathematics and its applications by Rosen, 5th Edition, TMH.
2. Elements Of Discrete Mathematics by C. L. Liu and D.P. Mohapatra, 3rd Edition, TMH.
3. Textbook Of Discrete Mathematics by Swapan Kumar Sarkar, S Chand.
4. Graph Theory by Reinhard Diestel, 5th Edition, Springer.

5. Graph Theory with Applications to Engineering and Computer Science by N.Deo, PHI.
6. Graph Theory by Frank Harary, Addison-Wesley Publishing.
7. Numerical Analysis and Computational Procedures by Mollah, New Central Book.
8. Computer Oriented Numerical Methods, 3rd Edition, V Rajaraman, PHI.