# **RAMAKRISHNA MISSION VIDYAMANDIRA**

(Residential Autonomous College under University of Calcutta)

# **Syllabus For B.Sc. Computer Science Honours**

For the session 2012-15

# Semester - III (July - December)

Paper – CMSA301 (Theory) MARKS: 75

## Discrete Mathematics & Graph Theory: (Marks 25)

Sets:

Relation, Equivalence Relation, Functions.

#### Counting Theory:

Pigeon Hole Principle (generalized statement, proof and simple applications to mathematical problems), Principle of Inclusion and Exclusion (generalized statement, proof and simple applications to mathematical problems), Permutations and Combinations(with and without repetition), Recurrence relation and Generating Function(Their applications to simple problems).

#### 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.

#### Graph Theory:

#### Definitions and related theorems:

Incidence function, Simple graph, Konigsberg problem ,Walks, Paths and Circuits, Euler's graphs, Hamiltonian paths and circuits, Finite and Infinite graphs, Directed and Undirected graphs, Degree, Isolated vertex, Pendant vertex, Null graphs, Subgraph, Connected and Disconnected graphs, Regular graph, Complete graph, Clique, Planar graph, Independence number of a graph, Bipartite graph, Biconnected graph, Graph isomorphism, Chromatic number and Graph coloring problem, Cut vertex, Bridge, Cut set, Weighted graph, Trees, Spanning tree, Radius and Diameter, Eccentricity and center.

## Formal Languages and Automata Theory: (Marks 25)

Definition and Properties of Formal Languages and Grammar; Automata:

Finite Automata, Deterministic and Non Deterministic, State Minimization, Output dependent classification: Mealy and Moore Machine;

## Regular Expression:

Identities and Proofs, Arden's Theorem, Pumping Lemma, Relation with Automata.

## Grammar and Language:

Definition and Properties, Chomsky Classification of Grammars: Context

Sensitive Grammar, Context Free Grammar and Regular Grammar. *Linear Bounded Automata, Pushdown Automata:* Basic Concepts

Turing Machine: Concept and Design.

## Design & Analysis of Algorithm: (Marks 25)

#### Introduction to Algorithms:

Definition, Characteristics, Recursive and Non-recursive algorithms.

#### Asymptotic Complexity Analysis of Algorithms:

Space and Time Complexity, Concept of efficiency of an algorithm. Growth of Functions, Polynomial and Exponential Algorithms, Theoretical concept and mathematical problems regarding Big O Notation, Big Omega and Big-Theta Notations, Best case/worst case/average case analysis of well-known algorithms.

#### Algorithm Design Techniques:

Divide and conquer: General issues in Divide and conquer, Case study of selected searching and sorting problems as divide and conquer techniques: Strassen's Matrix Multiplication Method.

*Dynamic programming*: General issues in Dynamic Programming, Case study of Binomial Coefficient computation,

Concepts and simple case studies of Greedy algorithms.

#### Graph Representation and Algorithm:

Linked Representation, Matrix representations of graphs, Incidence, Adjacency and Circuit matrices, Graph operations.

Graph searching algorithms (BFS,DFS), Minimal spanning trees (Prim's Algorithm, Kruskal's Algorithm), Shortest paths (Floyd's Algorithm, Floyd-Warshall Algorithm, Dijkstra's Algorithm).

Classification of Problems: P, NP, Cook's Theorem (Statement Only).

#### Marks: 25

#### Graph Algorithm Laboratory: (Marks 10)

Implementation of Graph algorithms.

## Fundamentals of Linux & Shell Programming Laboratory: (Marks 15)

*Files & Directories :* Copy, delete, rename, compare files, create, navigate, remove directories, vi editor, status of users, background jobs; Pipes & filters; cutting, pasting and sorting of files, pattern searching in a string.

Shell Programming: Concept and simple programming problems.

## **References:**

- 1. Discrete Mathematics and Its Applications by Rosen, 5<sup>th</sup> Edition, TMH
- 2. Discrete Mathematics by C.L.Liu, Mohapatra; TMH.
- 3. Mathematical Foundations of Computer Science by GSS Bhishma Rao, Scitech Publishers
- 4. Introduction to Theory of Computation, by M. Sipser.
- 5. Graph Theory by Narsingh Deo, PHI.
- 6. Introduction to Graph Theory by D B West, 2<sup>nd</sup> edition, Pearson Education.
  7. Introduction to Automata Theory. Languages. and Computation by Jeffrey D Ullman, Rajeev Motwani, John E. Hopcroft; Pearson Education.
  8. An Introduction to Formal Languages and Automata by Peter Linz; Narosa Publishing.
  9. Switching and Einity Automata Theory in With a Statement of Stat
- 9. Switching and Finite Automata Theory by Kohavi, TMH.
- 10. Theory of Computer Science (Automata, Languages & Computation) by K L P Misra & N Chandrasekharan, PHI.
- 11.Introduction to Algorithms by Cormen et al (PHI)
- 12. Algorithms & Data structure by H.Sahani et al
- 13. The Design and Analysis of Computer Algorithms by Aho et al.
- 14. The Art of Programming by Knuth.
- 15. Unix concepts and Applications by Sumitava Das.
- 16. Unix Shell Programming by Y.Kanetkar