Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each module and not more than two questions from any module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 70

CS09 702: DESIGN AND ANALYSIS OF ALGORITHMS

Teaching scheme **Credits:** 5
4 hours lecture and 1 hour tutorial per week

Objectives

- *To provide a sound basis of algorithm design and analysis techniques.*
- *To introduce the various computing models and their capabilities with respect to computing.*

Module I (16 hours)
Analysis: RAM Model - Cost estimation based on key operations - big Oh - big omega - little Oh - omega and theta notations - recurrence analysis - Master's Theorem - Solution to recurrence relations with full history probabilistic analysis - linearity of expectations - Worst and Average case analysis of Quick Sort -Merge Sort - Heap Sort - Binary Search - Hashing Algorithms - lower bound proofs for the above problems -amortized analysis - aggregate - accounting and potential methods - Analysis of Knuth - Morris-Pratt algorithm - Amortised weight balanced trees - Red-Black Trees.

Module II (16 hours)
Design: Divide and Conquer - Strassen's algorithm, o(n) median finding algorithm - Dynamic programming - Matrix Chain Multiplication - Optimal polygon triangulation - Optimal Binary Search trees - Floyd-Warshall algorithm - CYK algorithm - Greedy-Huffman coding - Knapsack, Kruskal's and Prim's algorithms for MST – backtracking - branch and bound - traveling Salesman Problem - Matroids and theoretical foundations of Greedy algorithms.

Module III (15 hours)
Complexity: Complexity classes - P, NP, Co-NP, NP Hard and NP Complete problems - Cook's theorem(Proof not expected) - NP- Completeness reductions for clique - Vertex Cover - Subset Sum -Hamiltonian Cycle - TSP - integer programming - approximation algorithms - Vertex Cover - TSP-Set covering and subset sum - Bin packing - Graph coloring.

Module IV (18 hours)
Probabilistic algorithms: Pseudo random number generation methods - Monte Carlo algorithms - Probablistic counting - Verifying matrix multiplication - Primality testing - Miller Rabin Test – integer Facorisation - Pollard's rho heuristic - amplification of stochastic advantage - application to cryptography - interactive proof systems - les vegas algorithms - Randomized selection and sorting - Randomized solution for eight queen problem -Universal Hashing - Dixon's integer factorization algorithm.

Text Books

1. Corman T.H, Lieserson C.E & Rivest R.L, *Introduction to Algorithms*, Prentice Hall India, Modules I, II and III.
2. Motwani R. & Raghavan P, *Randomized Algorithms*, Cambridge University Press, Module IV

Reference Books

1. Basse S., *Computer Algorithms: Introduction to Design And Analysis*, Addison Wesley
2. Manber U., *Introduction to Algorithms: A Creative Approach*, Addison Wesley
3. Aho V., Hopcroft J.E. & Ullman J.D., *The Design And Analysis of Computer Algorithms*, Addison Wesley
4. Kenneth A Berman, Jerome L. Paul, *Fundamentals of sequential and parallel algorithms*, Vidya Vikas Publications

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