4MCACC2: DESIGN AND ANALYSIS OF ALGORITHMS

Total No. of Hours: 52 **Hours/Week: 04**

Course Objective: To analyse the asymptotic performance & demonstrate a familiarity with major algorithms. Understand various algorithmic design paradigms and apply methods of analysis.

Course Outcome: Students will be able to

CO1: Explain fundamental concepts of algorithm design and analyse its efficiency using asymptotic notations

CO2: Understand various algorithm design techniques and compare them

CO3: Apply algorithm design techniques to various problems and obtain time-complexity

CO4: Apply algorithm design techniques to graph oriented problems

CO5: Understand and apply Back tracking and Branch and bound techniques to real time applications

CO6: Understand the fundamental concepts of P, NP and NP-Complete problems

Unit I	**Introduction**: What is an algorithm? Fundamentals of Algorithmic problem solving, problem types, fundamental data structures. **Fundamentals of the analysis of Algorithm Efficiency:** Analysis framework, Asymptotic Notations and Basic efficiency classes. **Analysis of Simple Algorithms**: Maximum of given numbers, Matrix multiplication, linear search, Factorial of a number using recursion, Tower of Hanoi.	10 hrs
Unit II	**Brute force**: Selection Sort, String Matching**. Divide-and-Conquer:** Merge Sort, Quick sort, Binary Search, Multiplication of large integers and Strassen's Matrix Multiplication. **Decrease-and-Conquer**: Decrease by constant, by a constant factor, variable size decrease - Insertion Sort, Depth-First-Search and Breadth-First-search graph traversals. **Transform-and-Conquer:** Horner's rule.	12 hrs
Unit III	**Dynamic Programming**: Knapsack problem, Optimal Binary Search Tree, Optimal Parenthesization for product of sequence of matrices.	10 hrs
Unit IV	**Greedy Technique**: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees.	10 hrs
Unit V	**Limitations of Algorithm Power**: Lower Bound Theory, Decision Trees, P, NP & NP-Complete problems. **Coping with the Limitations of Algorithm Power**: Back Tracking: n-Queens problem. **Branch & Bound**: Travelling Salesman problem.	10 hrs

REFERENCE BOOKS

[1] AnanyLevitin, "*Introduction to the Design and Analysis of Algorithms*", Pearson Education, Second Edition.

[2] E. Horowitz and S. Sahani, "*Fundamentals of Computer Algorithms*", Galgotia Publications.

[3] Aho, Hopcraft and Ullman, "*Design and Analysis of Computer Algorithms*", Addison-Wesleyseries.

[4] Thomas H Coreman, Charles E Leiserson and Ronald L Rivest, CliffordStien, *"Introduction to Algorithms*", Prentice Hall of India Pvt. Ltd.