



**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**Syllabus for Integrated MSc, 5<sup>th</sup> Semester**  
**Branch: Computer Science**  
**Subject Name: Design and Analysis of Algorithms**  
**Subject Code: 1350302**

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (I)	ESE (V)	
4	0	2	5	70	30	20	30	150

**Content:**

Sr. No.	Content	Teaching Hours	Module Weightage (%)
1.	<b>Analysis of Algorithm:</b> Characteristic of algorithm, The efficient algorithm, Average, Best and worst case analysis, Asymptotic Notations, Analyzing control statement, Sorting Algorithms and analysis: Bubble sort, Selection sort, Insertion sort, Shell sort, Heap sort, Sorting in linear time : Bucket sort, Radix sort	07	20%
2.	<b>Divide and Conquer Algorithm:</b> Introduction, Recurrence and different methods to solve recurrence, Multiplying large Integers Problem, Problem Solving using divide and conquer algorithm - Binary Search, Max-Min problem, Sorting (Merge Sort, Quick Sort), Matrix Multiplication	08	15%
3.	<b>Greedy Algorithm :</b> General Characteristics of greedy algorithms, Problem solving using Activity selection problem, Elements of Greedy Strategy, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Graphs: Shortest paths, The Knapsack Problem, Job Scheduling Problem, Huffman code	08	20
4.	<b>Dynamic Programming:</b> Introduction, The Principle of Optimality, Problem Solving using Dynamic Programming – Calculating the Binomial Coefficient, Making Change Problem, Assembly Line-Scheduling, Knapsack problem, All Points Shortest path, Matrix chain multiplication, Longest Common Subsequence	07	15%
5.	<b>Exploring Graphs:</b> An introduction using graphs and games, Undirected Graph, Directed Graph, Traversing Graphs, Depth First Search, Breath First Search, Topological sort, Connected components	04	10%
6.	<b>Backtracking and Branch and Bound:</b> Introduction, The Eight queens problem , Knapsack problem, Travelling Salesman problem, Minimax principle	04	10%
7.	<b>String Matching :</b> Introduction, The naive string matching algorithm, The Rabin-Karp algorithm, String Matching with finite automata. The class P and NP, Introduction to NP-Completeness	04	10%



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**Reference Books:**

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, PHI.
2. Fundamentals of Algorithms – E. Horowitz et al.
3. Fundamental of Algorithms by Gills Brassard, Paul Bratley, PHI.
4. Introduction to Design and Analysis of Algorithms, Anany Levitin, Pearson.
5. Foundations of Algorithms, Shailesh R Sathe, Penram
6. Design and Analysis of Algorithms, Dave and Dave, Pearson.

**Course Outcome:**

**After learning the course the students should be able to:**

Sr. No.	CO Statement
CO-1	Analyse the asymptotic performance of algorithms
CO-2	Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
CO-3	Find Solutions using greedy approach.
CO-4	Find optimal solution by applying various methods.
CO-5	Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate.

**List of Suggested titles of Experiments (If Any):**

1. Implementation and Time analysis of sorting algorithms.
2. Bubble sort, Selection sort, Insertion sort, Merge sort and Quick sort
3. Implementation and Time analysis of linear and binary search algorithm.
4. Implementation and Time analysis of factorial program using iterative and recursive method.
5. Implementation of a knapsack problem using dynamic programming
6. Implementation of chain matrix multiplication using dynamic programming.
7. Implementation of making change problem using dynamic programming
8. Implementation of a knapsack problem using greedy algorithm
9. Implement prim's algorithm
10. Implement kruskal's algorithm.
11. Implement LCS problem