Course Code	Course Name	Credits
20MCACC303	Design and Analysis of Algorithms	04

❖ Aim of the Course:

1	The aim of this course is to teach techniques for effective problem solving in computing. The use of different techniques of problem solving will be used to explain clever and efficient ways to solve a given problem. In every case stress would be given on proving correctness of the algorithm. The analysis of the algorithm will be used to demonstrate the efficiency of the algorithm over the naive techniques.

❖ Course Overview and Context:

1	The course is divided into five units. In the first unit we would focus on fundamentals of algorithms and its time complexity. In the second unit we would learn Divide and Conquer strategy. Various Greedy methods and Dynamic programming techniques will be the focus of third unit. The backtracking technique will be covered in the fourth unit. In the fifth unit Branch and Bound techniques will be covered.

❖ Course Outcomes:

Sr #	Course Outcome	Cognitive Level
1	**Recall** the factors affecting the efficiency of algorithms.	Remember
2	**Recognize** limitations of Divide and Conquer paradigm. **Distinguish** between Divide and Conquer & Decrease and Conquer.	Remember, Understand
3	**Recall** and **distinguish** the working of Greedy methods and Dynamic programming. **Illustrate** the working of Greedy methods and Dynamic programming.	Remember, Understand
4	**Recall** and **Illustrate** the working of various Backtracking techniques.	Remember, Understand
5	**Recall** Polynomial-Time and Non-Polynomial-Time. **Recall and Illustrate** the working of various Branch and Bound techniques.	Remember, Understand

❖ Content of the Course:

Unit-1 Basics of Design and Analysis of Algorithms

- Introduction; basic steps to solve a problem using computer; examples;
- An overview of Top-down design and Recursion; Correct use of Loops in programs;
- Factors affecting efficiency of algorithms; Estimating and specifying execution times;
- Order notation: Big-oh, Omega, Theta, small omega, small-oh
- Design using Recursion

Unit-2 Divide and Conquer Strategy

- Analysis of Multiplication algorithm and its limitations using examples;
- Limitations of Divide and Conquer strategy
- Decrease-and-Conquer approach with examples.

Unit-3 Greedy Methods, Dynamic Programming

- Greedy methods- an introduction
- Knapsack problem; Job sequencing with deadlines;

- Minimum spanning trees: Prim's algorithm, Kruskal's algorithm;
- Optimal merge pattern;
- Shortest path: Dijkstra's shortest path algorithm.

Unit-4 Backtracking

- Combinatorial search;
- Search and traversal: BFS, DFS;
- Backtracking strategy: 8-Queen problem; Backtracking framework, Efficiency of backtracking and examples;
- Some typical state spaces: Constructing all subsets, Constructing all permutations.

Unit-5 Branch and Bound Algorithms

- Shortest path, 16-Puzzle and 8-Puzzle, Scale balancing, 0/1 Knapsack problem, Traveling salesman problem.
- Polynomial-Time (P) and Non-Polynomial-Time (NPT) Algorithms, Worst and Average Case Behavior.

❖ Learning Resources:

Sr #	Textbook | References | Internet Links
1	"Parag H Dave", "Himanshu B Dave", "Design and Analysis of Algorithms", Pearson Second Edition (2014)
2	"Thomas H. Cormen", "Charles E. Leiserson", "Ronald L Rivest", "Clifford Stein", "Introduction to Algorithms", PHI, 2nd Edition.
3	S. Baase, "Computer Algorithms: Introduction to Design and Analysis", Pearson (2002).

❖ Assignments (Optional):

Sr #	Description	Available From (Date)	Submission Date
1	Unit-1 and Unit-2	After 3 Weeks	Within 10 Days
2	Unit-3 and Unit-4	After 6 Weeks	Within 10 Days