

**DESIGN AND ANALYSIS OF ALGORITHMS**  
[As per Choice Based Credit System (CBCS) scheme]  
(Effective from the academic year 2017 -2018)

**SEMESTER – IV**

Subject Code	17CS43	IA Marks	40
Number of Lecture Hours/Week	04	Exam Marks	60
Total Number of Lecture Hours	50	Exam Hours	03

**CREDITS – 04**

**Module 1**

**Introduction:** What is an Algorithm? (T2:1.1), Algorithm Specification (T2:1.2), Analysis Framework (T1:2.1), **Performance Analysis:** Space complexity, Time complexity (T2:1.3). **Asymptotic Notations:** Big-Oh notation ( $O$ ), Omega notation ( $\Omega$ ), Theta notation ( $\Theta$ ), and Little-oh notation ( $o$ ), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples (T1:2.2, 2.3, 2.4). **Important Problem Types:** Sorting, Searching, String processing, Graph Problems, Combinatorial Problems. **Fundamental Data Structures:** Stacks, Queues, Graphs, Trees, Sets and Dictionaries. (T1:1.3,1.4)

**Teaching Hours**

**10 Hours**

**Module 2**

**Divide and Conquer:** General method, Binary search, Recurrence equation for divide and conquer, Finding the maximum and minimum (T2:3.1, 3.3, 3.4), Merge sort, Quick sort (T1:4.1, 4.2), Strassen's matrix multiplication (T2:3.8), Advantages and Disadvantages of divide and conquer. **Decrease and Conquer Approach:** Topological Sort. (T1:5.3)

**10 Hours**

**Module 3**

**Greedy Method:** General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines (T2:4.1, 4.3, 4.5). **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm (T1:9.1, 9.2). **Single source shortest paths:** Dijkstra's Algorithm (T1:9.3). **Optimal Tree problem:** Huffman Trees and Codes (T1:9.4). **Transform and Conquer Approach:** Heaps and Heap Sort (T1:6.4).

**10 Hours**

**Module 4**

**Dynamic Programming:** General method with Examples, Multistage Graphs (T2:5.1, 5.2). **Transitive Closure:** Warshall's Algorithm, **All Pairs Shortest Paths:** Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem ((T1:8.2, 8.3, 8.4), Bellman-Ford Algorithm (T2:5.4), Travelling Sales Person problem (T2:5.9), Reliability design (T2:5.8).

**10 Hours**

**Module 5**

**Backtracking:** General method (T2:7.1), N-Queens problem (T1:12.1), Sum of subsets problem (T1:12.1), Graph coloring (T2:7.4), Hamiltonian cycles (T2:7.5). **Branch and Bound:** Assignment Problem, Travelling Sales Person problem (T1:12.2), 0/1 Knapsack problem (T2:8.2, T1:12.2): LC Branch and Bound solution (T2:8.2), FIFO Branch and Bound solution (T2:8.2). **NP-Complete and NP-Hard problems:** Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes (T2:11.1).

**10 Hours**

**Course Outcomes:** After studying this course, students will be able to

- Describe computational solution to well known problems like searching, sorting etc,
- Estimate the computational complexity of different algorithms.

- Develop an algorithm using appropriate design strategies for problem solving.

**Question paper pattern:**

The question paper will have ten questions.

There will be 2 questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

T1. Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 2nd Edition, 2009, Pearson.

T2. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press

**Reference Books:**

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI

2. Design and Analysis of Algorithms , S. Sridhar, Oxford (Higher Education)



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