DESIGN AND ANALYSIS OF ALGORITHMS
(Effective from the academic year 2018 -2019)
SEMESTER – IV

Course Code	**18CS42**	**CIE Marks**	40
Number of Contact Hours/Week	3:2:0	**SEE Marks**	60
Total Number of Contact Hours	50	**Exam Hours**	03

CREDITS –4

Course Learning Objectives: This course (18CS42) will enable students to:

- Explain various computational problem solving techniques.
- Apply appropriate method to solve a given problem.
- Describe various methods of algorithm analysis.

Module 1	**Contact Hours**
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 (Ω), Theta notation (Θ), 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).** **RBT: L1, L2, L3**	10
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).** **RBT: L1, L2, L3**	10
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).** **RBT: L1, L2, L3**	10
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).** **RBT: L1, L2, L3**	10
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). Programme and Bound:** Assignment Problem, Travelling Sales Person problem **(T1:12.2), 0/1 Knapsack problem (T2:8.2, T1:12.2):** LC Programme and Bound solution **(T2:8.2)**, FIFO Programme 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).** **RBT: L1, L2, L3**	10

Course Outcomes: The student will be able to :

- Describe computational solution to well known problems like searching, sorting etc.

- Estimate the computational complexity of different algorithms.
- Devise an algorithm using appropriate design strategies for problem solving.

Question Paper Pattern:

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Textbooks:

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