DESIGN AND ANALYSIS OF ALGORITHMS

[As per Choice Based Credit System (CBCS) scheme]

(Effective from the academic year 2016 -2017)

SEMESTER – IV

Subject Code	15CS43	IA Marks	20
Number of Lecture Hours/Week	04	Exam Marks	80
Total Number of Lecture Hours	50	Exam Hours	03

CREDITS – 04

Course objectives: This course 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	**Teaching 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)**	**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	**10 Hours**

concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes **(T2:11.1)**.

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

Graduate Attributes

- Engineering Knowledge
- Problem Analysis
- Design/Development of Solutions
- Conduct Investigations of Complex Problems
- Life-Long Learning

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:, 2rd 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)

H. O. D.
Dept. Of Computer Science & Engineering
Alva's Institute of Engg. & Technology
Mijar, MOODBIDRI - 574 225