DESIGN AND ANALYSIS OF ALGORITHMS

IV Semester: CSE / IT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AITB05	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

COURSE OBJECTIVES:

The course should enable the students to:

I. Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
II. Solve problems using data structures such as binary search trees, and graphs and writing programs for these solutions.
III. Choose the appropriate data structure and algorithm design method for a specified application.
IV. Solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking, and branch and bound and writing programs for these solutions.

COURSE OUTCOMES:

CO1: Understand the concept of pseudo code for writing an algorithm and acquire ability to analyze the asymptotic performance of various algorithms

CO2: Explore the concept of trees and graphs and get familiarity of analysis of various graph, tree traversal algorithms.

CO3: Understand algorithm designing techniques such as Greedy approach Dynamic programming and explore to various related application problems.

CO4: Synthesize efficient algorithm design paradigms back tracking , Branch & Bound in solving common analytical problems.

CO5: Understand the variations among tractable and intractable problems and able to classify P and NP classes.

COURSE LEARNING OUTCOMES:

1. Describe Pseudo code for expressing algorithms.
2. Summarize the concept of Space complexity, time complexity.
3. Describe Big O notation, omega notation, theta notation, little o notation and amortized complexity.
4. Use the concept of Divide and Conquer such as general method, binary search, quick sort.
5. Describe the concept of merge sort, Strassen's matrix multiplication.
6. Determine disjoint set operations, union and find algorithms.
7. Understand efficient non recursive binary tree traversal algorithms.
8. Describe the concept of spanning trees with suitable examples.
9. Use breadth first search and depth first search graph traversals.
10. Describe connected components, biconnected components.
11. Understand general method of greedy method, job sequencing with deadlines, knapsack problem.
12. Analyze the concept of minimum cost spanning trees, single source shortest paths.
13. Describe general method of dynamic programming, matrix chain multiplication.
14. Understand optimal binary search trees, 0/1 knapsack problem, single source shortest paths.
15. Define all pairs shortest paths problem, the travelling salesperson problem.
16. Discuss the concept of Backtracking, the 8 queens problem.
17. Understand sum of subsets problem, graph coloring.
18. Summarize the concept of Hamiltonian cycles, Branch and bound.
19. Discuss 0/1 knapsack problem, least cost branch and bound solution.
20. Apply the concept of first in first out branch and bound solution, travelling salesperson problem.
21. Knowledge about basic concepts of NP Hard and NP Complete, Non-deterministic algorithms.
22. Apply Working with the classes NP - Hard and NP.

23. Understand NP Hard problems, clique decision problem.
24. Implement chromatic number decision problem.
25. Discuss Cook's theorem in NP Hard and NP Complete problems.

MODULE -I	INTRODUCTION	Classes: 09

Algorithm: Pseudo code for expressing algorithms; Performance analysis: Space complexity, time complexity; Asymptotic notations: Big O notation, omega notation, theta notation and little o notation, amortized complexity; Divide and Conquer: General method, binary search, quick sort, merge sort, Strassen_s matrix multiplication.

MODULE -II	SEARCHING AND TRAVERSAL TECHNIQUES	Classes: 08

Disjoint set operations, union and find algorithms; Efficient non recursive binary tree traversal algorithms, spanning trees; Graph traversals: Breadth first search, depth first search, connected components, biconnected components.

MODULE -III	GREEDY METHOD AND DYNAMIC PROGRAMMING	Classes: 10

Greedy method: The general method, job sequencing with deadlines, knapsack problem, minimum cost spanning trees, single source shortest paths.

Dynamic programming: The general method, matrix chain multiplication optimal binary search trees, 0/1 knapsack problem, single source shortest paths, all pairs shortest paths problem, the travelling salesperson problem.

MODULE -IV	BACKTRACKING AND BRANCH AND BOUND	Classes: 09

Backtracking: The general method, the 8 queens problem, sum of subsets problem, graph coloring, Hamiltonian cycles; Branch and bound: The general method, 0/1 knapsack problem, least cost branch and bound solution, first in first out branch and bound solution, travelling salesperson problem.

MODULE -V	NP-HARD AND NP-COMPLETE PROBLEM	Classes: 09

Basic concepts: Non-deterministic algorithms, the classes NP - Hard and NP, NP Hard problems, clique decision problem, chromatic number decision problem, Cook's theorem.

Text Books:

1. Ellis Horowitz, Satraj Sahni, Sanguthevar Rajasekharan, ―Fundamentals of Computer Algorithms, Universities Press, 2nd Edition, 2015.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D, ―The Design And Analysis Of Computer Algorithms, Pearson India, 1st Edition, 2013.

Reference Books:

1. Levitin A, ―Introduction to the Design and Analysis of Algorithms‖, Pearson Education, 3rd Edition, 2012.
2. Goodrich, M. T. R Tamassia, ―Algorithm Design Foundations Analysis and Internet Examples‖, John Wileyn and Sons, 1st Edition, 2001.
3. Base Sara Allen Vangelder, ―Computer Algorithms Introduction to Design and Analysis‖, Pearson, 3rd Edition, 1999.