Advanced Data Structures & Algorithm Analysis

MICRO SYLLABUS

Course Code:	23CS3301/ 23AM3301/ 23DS3301	**Year:**	II	**Semester:**	I
Course Category:	Professional Core Course	**Branch:**	CSE/ AI&ML/DS	**Course Type**	Theory
Credits:	3	**L-T-P:**	3-0-0	**Prerequisites**	Data Structures through C/ Object Oriented Programming
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks**	100

COURSE OUTCOMES		
Upon successful completion of the course, Student will be able to		
CO1	Understand the fundamental concepts of algorithm analysis and design techniques.	**L2**
CO2	Apply various algorithm design techniques for solving problems	**L3**
CO3	Apply the concepts of Trees and Graphs for solving problems effectively.	**L3**
CO4	Analyze the given scenario and choose appropriate algorithm design for solving problems.	**L4**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	Program Outcomes (Pos)												**PSOs**	
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3													
CO2		3							1	1			3	1
CO3		2							1	1			3	1
CO4		2	1						1	1				

Unit No.	SYLLABUS CONTENTS	Mapped CO
I	**Introduction:** Algorithm Analysis: Understand definition and characteristics of algorithm, and conventions used for specification of algorithm. Space complexity, Time Complexity analysis: Count variable method, Frequency count method. Asymptotic Notations: Big Oh, Big omega, Theta notations **Trees –** AVL: Single Rotation, Double Rotation, ADT operations: insertion, deletion, searching, traversing a tree. **B-Trees**: representation, ADT operations: Insertion, deletion, traversing a tree	**CO1, CO3**
II	**Heap Trees** (Priority Queues) – Priority queue definition, representation, construction of Min and Max Heaps, Operations: insertion, deletion **Graphs** – Terminology, Representations: adjacency matrix, adjacency list, incidence matrix, Basic Search and Traversals techniques: BFS, DFS, Sets and Disjoint set Union: Simple union, simple find.	**CO1,CO3**
III	**Divide and Conquer:** General Method: Recurrence relations – substitution method, **Applications**: Max-Min, Quick Sort, Merge Sort, Strassen's matrix multiplication **Greedy Method:** General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees: Prims, Kruskal's, Single Source Shortest Paths :Dijkstra's algorithm	**CO1, CO2,CO3, CO4**
IV	**Dynamic Programming:** General Method, All pairs shortest paths, Single Source Shortest Paths- General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing,: LCS problem, Travelling Salesperson problem.	**CO1, CO2,CO3, CO4**
V	**Backtracking:** General Method, n-Queens Problem (upto n=4), Sum of Subsets problem, Graph Coloring, **Branch and Bound:** The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem. **Introduction to Complexity classes:** P and NP: definitions:- P class, NP class, NP complete problems.	**CO1, CO2,CO3, CO4**

Learning Resources

Text Books

1.Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, 2nd Edition Universities Press

2.Computer Algorithms in C++, Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition University Press

3. Fundamentals of Computer Algorithms, Ellis Horowitz, SartajSahni , Sanguthevar Rajasekaran, 2nd Edition, Universities Press,

References Text Book

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein&Tanenbaum, Pearson, 1995
5. Fundamentals of Data Structures in C++: Horowitz Sahni& Mehta, Galgottia Pub.
6. Data structures in Java:, Thomas Standish, Pearson Education Asia

e-Resources and other Digital Material

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. http://peterindia.net/Algorithms.html
3. Abdul Bari,Introduction to Algorithms (youtube.com)