23IT3304: ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-1-0
Prerequisites:	Data Structures	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Design an Algorithm and estimate the asymptotic performance of algorithms
	CO2	Synthesize design techniques and choose appropriate technique to solve problems.
	CO3	Analyze algorithm design techniques to provide optimal solution for given problem.
	CO4	Understand various operations on advanced tree data structures and asymptotic performance of algorithms.

Contribution of Course Outcomes towards achievement of Program Outcomes (1-Low, 2-Medium, 3- High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3										2	1
CO2	1	2	3	2									1	1
CO3	1	2	3	2									1	3
CO4		3	2										3	2

Course Content

UNIT I:

Introduction: What is an algorithm**,** Algorithm Specification: Pseudo code Conventions, Performance Analysis: Space Complexity, Time Complexity, Asymptotic Notation (Big ―oh, Omega, Theta, Little ―oh).

Divide and Conquer: General method, Binary search, Finding the Maximum and Minimum, Merge sort, Quick sort, Strassen‘s matrix multiplication.

UNIT II:

Greedy method: General method, knapsack problem, Job Sequencing with deadlines, Minimum cost spanning trees: Prim‘s and Kruskal‘s algorithms, Single source shortest path problem.

Dynamic Programming: General method, All pairs shortest Path problem, Single-source shortest paths: general weights, String Editing, 0/1 knapsack problem, Travelling salesperson problem.

	UNIT III: **Backtracking:** General method, 8-queens problem, sum of subsets, graph coloring, Hamiltonian cycles. **Branch and Bound:** The General method, 0/1knapsack problem, Travelling Salesperson Problem
	UNIT IV: **Trees:** AVL trees: Creation, insertion and deletion operations and Applications. B-Trees: Creation, insertion and deletion operations and Applications. Splay trees: A simple idea, splaying, Top-Down splay trees. Red-Black trees: Definition and Properties, Searching a Red-Black Tree, Top-Down Insertion, Bottom-Up Insertion, Deletion operations. Heap Trees(Priority queues): Min and Max Heaps, Operations and Applications **NP-Hard and NP-Complete problems**: Basic concepts, non-deterministic algorithms, the classes NP Hard and NP Complete.
Text books and Reference books	**Text Book(s):** [1]. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "FUNDAMENTALS OF DATA STRUCTURES in C++", 2nd edition, University Press. [2] Ellis. Horowitz, Sartaj Sahani, Sanguthevar Rajasekharan, "FUNDAMENTALS OF COMPUTER ALGORITHMS", 2nd edition, University Press. **Reference Books:** [1]. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", PHI learning Pvt.Ltd., New Delhi, 2010. [2]. Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python", 1st edition, Springer International Publishing, 2015.
E-resources and other digital material	[1] SudarshanIyengar,AssistantProfessor,CSE department, IIT Ropar, Programming, Data Structures and Algorithms [NPTEL], (26, May, 2021) Available: https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs25/ [2] Erik Demaine, professor of Computer Science at the Massachusetts Institute of Technology , Advanced Data Structures [MIT- Open Course Ware], (26, May, 2021) Available: http://ocw.mit.edu/ [3] https://www.tutorialpoint.com/advanced_data_structures/index.asp [4] http://peterindia.net/Algorithms.html