20IT4303- ADVANCED DATA STRUCTURES AND ALGORITHMS

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-1-0
Prerequisites:	20IT3302- Discrete Mathematics for Information Technology 20IT3303- 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	Understand various operations on advanced tree data structures and 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	Distinguish deterministic and non-deterministic algorithms and their performances.

Contribution of Course Outcomes towards achievement of Program Outcomes (L-Low, M-Medium, H- High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	L	H										M	L
CO2	L	M	H	M								M	L	L
CO3	L	M	H	M								L	L	H
CO4		H	M										H	M

Course Content

UNIT I:

Trees: Splay trees: A simple idea, splaying, Top-Down splay trees, Red-Black trees: Bottom-up insertion, Top-down-red-black trees, top-down deletion, Treaps, Suffix Arrays and Suffix Trees: Suffix Arrays, Suffix Trees, Linear-Time Construction of Suffix Arrays and Suffix Trees.

Introduction: Algorithm Specification: Pseudo code Conventions, Recursive Algorithms, Performance Analysis: Space Complexity, Time Complexity, Asymptotic Notation (Big ―oh, Omega, Theta, Little ―oh).

UNIT II:

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

	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.
	UNIT III: **Dynamic Programming:** General method, All pairs shortest Path problem, Travelling sales person problem, 0/1 knapsack problem, Reliability Design **Backtracking:** General method, 8-queens problem, sum of subsets, graph coloring, Hamiltonian cycles.
	UNIT IV: **Branch and Bound:** The method: Least Cost (LC) Search, Control Abstractions for LC-Search, FIFO Branch-and-Bound, LC Branch-and-Bound, 0/1knapsack problem: LC Branch and Bound solution, FIFO Branch and Bound solution, Travelling Salesperson. **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]. Mark Allen Weiss, "Data structure and Algorithm Analysis in C++", 4th edition, Addison Wesley Publication, 2014. [2]. E. Horowitz, et al, ―Fundamentals of Computer Algorithms, University Press(India)Pvt. Ltd, 2 Edition 2011. **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/