20CS023 DATA STRUCTURES AND ALGORITHMS

Hours Per Week :

L	T	P	C
3	-	-	3

Total Hours :

L	T	P
45	-	-

WA/RA	SSH/HSH	CS	SA	S	BS
15	30	-	5	5	-

Course Description and Objectives:

This course introduces students to the analysis and design of computer algorithms. The course is intended to provide the foundations of the practical implementation and usage of Algorithms and Data Structures. One objective is to ensure that the student evolves into a competent programmer capable of designing and analysing implementations of algorithms and data structures for different kinds of problems. The second objective is to expose the student to the algorithm analysis techniques, to the theory of reductions, and to the classification of problems into complexity classes like NP.

The students will be able to :

COs	Course Outcomes	POs
1	Analyze the asymptotic performance of algorithms	2
2	Demonstrate a familiarity with major algorithms and data structures	1, 2
3	Apply important algorithmic design paradigms and methods of analysis	1
4	Synthesize efficient algorithms in common engineering design situations	3, 5

SKILLS:

- ✓ Be able to Design and Analyse programming problem statements
- ✓ Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- ✓ Be able to understand the necessary mathematical abstraction to solve problems
- ✓ Be able to come up with analysis of efficiency and proofs of correctness
- ✓ To be able to comprehend and select algorithm design approaches in a problem specific manner

UNIT - I

Elementary Data Structures: Trees, binary heaps, Hashing, Balanced Search Trees - Properties and Abstract Data Types (ADT) of AVL, Red-Black and Splay Trees, Disjoint set data structure: Union-find

UNIT - II

Introduction to Algorithm Analysis: Algorithm, Asymptotic Notation Recurrences: Substitution, Iteration and master method

Divide and Conquer: General method, Applications - Binary search, Merge sort, Quick sort, Strassen's Matrix multiplication

Unit III

Greedy Method: General method, Applications - Fractional knapsack problem, Minimum cost spanning trees, Single source shortest path problem

Graph Algorithms: BFS, Applications of BFS, bipartite graphs, Depth First Search(DFS), Application Of DFS like Topological Sort, Cycle Detection, Checking Whether a Digraph is Strongly connected or not,

UNIT - IV

Dynamic Programming: General method, Applications - Matrix chain multiplication, Optimal binary search trees, 0/1 knapsack problem, All pairs shortest path problem, Travelling sales person problem and design, Longest Common Subsequence.

UNIT - V

Backtracking: General method, Applications - N-queen problem, Sum of subsets problem

Intractability and NP-Completeness: The class NP, Satisfiability, NP-hard and NP-complete problems, proving a problem is NP-complete. Approximation algorithms for NP-hard problems

TEXT BOOKS:

1. Ellis Horowitz, Sartaj Sahni and Rajasekaaran "Fundamentals of Computer Algorithms", second edition, University press.
2. Sartaj Sahni, "Data Structures, Algorithms and Applications in java", University Press.

REFERENCE BOOKS:

1. T.H.Cormen, C.E.Leiserson, R.L.Rivest,and C.Stein, "Introduction to Algorithms", second edition ,PHI Pvt. Ltd.
2. Aho, Ullman and Hopcroft, "Design and Analysis of algorithms", Pearson education.
3. Richard Johnson baugh and Marcus Schaefer , "Algorithm Design: Foundations, Analysis and Internet examples, Algorithms", Pearson Education.
4. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition by, Addison-Wesley.
5. Jon Kleinberg and Eva Tardos , "Algorithm Design", Pearson.