U23CS403	Design And Analysis of Algorithms	L	T	P	J	C
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1.Course Description

This course explores the fundamental principles of algorithmic design and analysis, equipping students with the essential tools to tackle complex computational problems efficiently. Through a comprehensive exploration of various algorithmic techniques, including Brute Force, Divide-and-Conquer, Dynamic Programming, Greedy Approach, Backtracking, and Branch and Bound, students will gain a profound understanding of how to formulate, analyze and optimize algorithms for diverse applications. Through hands-on exercises, projects and theoretical discussions, students will develop the skills necessary to design algorithms, assess their efficiency, and make informed decisions regarding algorithm selection for real-world problems.

2.Course Objectives

1. To understand the algorithm analysis techniques
2. To learn to the efficiency of alternative algorithmic solutions for the same problem
3. To understand different algorithm design techniques
4. To understand the limitations of Algorithmic Power

3.Syllabus

Unit-I: Algorithm Analysis Techniques

Notion of an algorithm , Importance & role of algorithms in computing , Important problem types ; Analysis of algorithmic efficiency , Time and Space Complexity , Asymptotic notations and their properties ; Analysis framework: Mathematical analysis for recursive and non-recursive algorithms; String Algorithms: Naïve algorithm , Rabin Karp Algorithm , KMP Algorithm , Manachers algorithm

Unit-II: Brute Force and Divide-And-Conquer

Brute force: Selection sort , String matching , Exhaustive search , Boyer Moore algorithm , Travelling salesman problem , Knapsack problem , Assignment problem , Huffman codes and data compression; Divide and Conquer: Binary search , Quick sort , Heap sort , Multiplication of large integer

Unit-III: Dynamic Programming

Ugly numbers ; Coin changing problem ; Friends pairing problem ; Golomb sequence ; Warshall's algorithm , Floyd's algorithm , Multi stage graph , Optimal binary search trees , Fractional Knapsack Problem , K Knight's tour on chess board

Unit-IV: Greedy Approach

Definition , Activity selection problem , Longest common subsequence , Sieve of Sundaram , Assign mice to holes; Huffman trees , Sparse matrix , Bloom filter

Unit-V: Backtracking and Branch and Bound
Backtracking , Rat in maze , Permutation and Combination , N Queen problem , Hamiltonian circuit problem , Knight's tour problem , Subset sum problem , Graph Coloring ; Branch and Bound: Assignment problem , Knapsack problem , Travelling salesman problem
Text Books:
1. Anany Levitin, ― Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2017
References:
Reference Books: 1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2008 2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2022

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
U23CS403.1	Understand the importance of designing strategies, time and space complexity	K2	1, 2, 3, 4, 5, 7, 12	1,2
U23CS403.2	Apply brute force and divide and conquer strategies in solving problems	K3	1, 2, 3, 4, 5, 7, 12	1,2
U23CS403.3	Apply dynamic programming in solving complex problems	K3	1, 2, 3, 4, 5, 7, 12	1,2
U23CS403.4	Apply greedy algorithms in solving problems	K3	1, 2, 3, 4, 5, 7, 12	1,2
U23CS403.5	Compare the time and space complexities of different types of algorithms	K3	1, 2, 3, 4, 5, 7, 12	1,2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
U23CS403.1	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
U23CS403.2	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
U23CS403.3	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
U23CS403.4	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
U23CS403.5	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
Course to PO	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-