

Course Code	Course Title	L	T	P	C
PMCA501L	Data Structures and Algorithms	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			
Course Objectives:					
1. To provide basic techniques of algorithm analysis and exhibit the capacity to implement various linked data structures.					
2. To become familiar with several sorting algorithms and demonstrate the applications of graph algorithms.					
3. To practice the various algorithm design techniques.					
Course Outcomes:					
1. Analyze and apply the time and space complexities of various algorithms					
2. Choose appropriate data structure for the specified problem					
3. Handle operations like searching, insertion, deletion and traversing mechanisms on various data structures					
4. Comprehend and apply linear and non-linear data structures to design algorithms					
5. Solve problems using different algorithm design techniques					
Module:1	Foundations on Algorithmic Analysis	7 hours			
The Role of Algorithms in Computing - Analyzing and Designing Algorithms - Characterizing Running Time - Asymptotic Notations - Formal Definition, Standard Notations and Common Functions - Solving Recurrence - Substitution Method - Recurrence Tree Method - Master Method					
Module:2	Elementary Data Structure - Stack, Queue and List	5 hours			
Stack and its Applications - Expression Conversion - Expression Evaluation - Balancing Parenthesis in Expression - Processing Functions Calls - Simple Queue - Circular, Priority Queue and its Applications - Singly Linked List - Circular Linked List - Doubly Linked List - Doubly Circular Linked List Operations and its Applications - Polynomial Representation and its Operations					
Module:3	Sorting and Order Statistics	6 hours			
Sorting - Insertion Sort, Shell Sort, Merge Sort, Radix Sort, Heap Sort - Searching - Linear Search, Binary Search - Time Complexity Analysis of Sorting and Searching Algorithms - Hashing - Hash Functions, Closed Addressing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing					
Module:4	Advanced Data Structure - Tree	6 hours			
Preliminaries - Binary Trees - Expression Tree - Binary Search Tree - AVL Tree - Splay Tree - B -Tree					
Module:5	Graph Algorithms	6 hours			
Representation of Graphs - Graph Traversals - Depth First Search - Breadth First Search - Minimum Spanning Trees - The Algorithms of Kruskal and Prim - Single Source Shortest Path - Bellman-Ford Algorithm - Dijkstra's Algorithm					
Module:6	Advanced Design Analysis Techniques - Greedy and Divide & Conquer	6 hours			

Greedy Algorithms - Huffman Code - Bin Packing - Divide and Conquer - Quicksort - Strassen's Matrix Multiplication			
Module:7	Advanced Design Analysis Techniques - Backtracking and Dynamic Programming		7 hours
Backtracking - N-Queens Problem, Longest Common Subsequence, Dynamic Programming - Knapsack Problem - Ordering Matrix Multiplication - All Pairs Shortest Path Problem - Floyd-Warshall Algorithm			
Module:8	Contemporary Issues		2 hours
Guest Lecture from Industry and R & D Organizations			
	Total Lecture hours:		45 hours
Text Book(s)			
1.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 2022, 4 <sup>th</sup> Edition, MIT Press, USA.		
Reference Books			
1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 2019, 4 <sup>th</sup> Edition, Pearson Education, Delhi.		
2.	Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data structures and Algorithms in Python", 2013, John Wiley and Sons, Inc., United States of America.		
Mode of Evaluation: CAT, Written Assignment, Quiz, FAT and Seminar			
Recommended by Board of Studies		04-05-2023	
Approved by Academic Council		No. 70	Date 24-06-2023