

**DATA STRUCTURES LAB**  
(Common to CSE, IT, CSE (AI&ML), CSE (Data Science))

<b>Course Code:</b>	23DS3251	<b>Year:</b>	I	<b>Semester:</b>	II
<b>Course Category:</b>	Professional Core	<b>Branch:</b>	CSE(DS)	<b>Course Type:</b>	Practical
<b>Credits:</b>	1.5	<b>L-T-P:</b>	0-0-3	<b>Prerequisites:</b>	Computer Programming Lab
<b>Continuous Internal Evaluation:</b>	30	<b>Semester End Evaluation:</b>	70	<b>Total Marks:</b>	100

<b>COURSE OUTCOMES</b>		
<b>Upon successful completion of the course, Student will be able to:</b>		
<b>CO1</b>	Apply Linear and non-linear data structures for solving problems.	L3
<b>CO2</b>	Implement programs as an individual on different IDEs.	L3
<b>CO3</b>	Develop an effective report based on various programs implemented.	L3
<b>CO4</b>	Apply technical knowledge for a given problem and express with an effective oral communication.	L3
<b>CO5</b>	Analyze outputs using given constraints/test cases.	L4

<b>Contribution of Course Outcomes towards achievement of Program Outcomes &amp; Strength of correlations (3: Substantial, 2: Moderate, 1: Slight)</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	3													
<b>CO2</b>	2				1									
<b>CO3</b>										3				
<b>CO4</b>										3				
<b>CO5</b>		3										2		

<b>Syllabus</b>		
<b>Unit No.</b>	<b>Contents</b>	<b>Mapped CO</b>
<b>1.</b>	Exercise 1: Array Manipulation i) Write a program to reverse an array. ii) C Programs to implement the Searching Techniques – Linear & BinarySearch	<b>CO1, CO2, CO3,CO4, CO5</b>
<b>2.</b>	Exercise 2: Sorting i) C Programs to implement Sorting Techniques – Bubble sort, Selection sort and Insertion Sort	<b>CO1, CO2, CO3,CO4, CO5</b>
<b>3.</b>	Exercise 3: Linked List Implementation i) Implement a singly linked list and perform insertion and deletion operations. ii) Develop a program to reverse a linked list iteratively and recursively. iii) Find minimum and maximum element in a linked list.	<b>CO1, CO2, CO3,CO4, CO5</b>
<b>4.</b>	Exercise 4: Linked List Applications i) Implement a linked list to represent polynomials and perform addition. ii) Develop a program to append one linked list to the end of the other. iii) Implement a circular linked list and perform insertion, deletion, and traversal.	<b>CO1, CO2, CO3,CO4, CO5</b>
<b>5.</b>	Exercise 5: Doubly Linked List Implementation i) Implement a doubly linked list and perform insertion and deletion operations.	<b>CO1, CO2, CO3,CO4, CO5</b>
<b>6.</b>	Exercise 6: Stack Operations i) Implement a stack using arrays and linked lists. ii) Write a program to evaluate a postfix expression using a stack. iii) Implement a program to check for balanced parentheses using a stack.	<b>CO1, CO2, CO3,CO4, CO5</b>
<b>7.</b>	Exercise 7: Queue Operations i) Implement a queue using arrays and linked lists. ii) Implement a circular queue and perform insertion and deletion operations.	<b>CO1, CO2, CO3,CO4, CO5</b>
<b>8.</b>	Exercise 8: Stack and Queue Applications i) Use a stack to evaluate an infix expression and convert it to postfix. ii) Create a program to determine whether a given string is a palindrome or not.	<b>CO1, CO2, CO3,CO4, CO5</b>
<b>9.</b>	Exercise 9: Binary Search Tree i) Implementing a BST using Linked List. ii) Traversing of BST.	<b>CO1, CO2, CO3,CO4, CO5</b>
<b>10.</b>	Exercise 10: Hashing i) Implement a hash table with collision resolution techniques.	<b>CO1, CO2, CO3,CO4, CO5</b>

<b>Learning Resources</b>
<b>Text Books</b>
<ol style="list-style-type: none"> <li>1. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, Second Edition, 2002, Pearson.</li> <li>2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Third Edition, 2010, PHI.</li> <li>3. Data Structures and Algorithms Made Easy by Narasimha Karumanchi, 2020, CareerMonk Publications.</li> <li>4. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed, Silicon Press, 2008.</li> </ol>
<b>References</b>
<ol style="list-style-type: none"> <li>1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders.</li> <li>2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft.</li> <li>3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum.</li> <li>4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.</li> <li>5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick.</li> </ol>
<b>e-Resources &amp; other digital material</b>
<ol style="list-style-type: none"> <li>1. <a href="https://www.cs.usfca.edu/~galles/visualization/Algorithms.html">https://www.cs.usfca.edu/~galles/visualization/Algorithms.html</a></li> <li>2. <a href="http://www.algomatic.com/algorithm/single-linked-list-insert-delete">http://www.algomatic.com/algorithm/single-linked-list-insert-delete</a></li> <li>3. <a href="http://www.algomatic.com/algorithm/binary-tree-insert-delete-display">http://www.algomatic.com/algorithm/binary-tree-insert-delete-display</a></li> <li>4. <a href="https://www.youtube.com/watch?v=AfYqN3fGapc">https://www.youtube.com/watch?v=AfYqN3fGapc</a></li> <li>5. <a href="https://www.youtube.com/watch?v=7vw2iIdqHIM">https://www.youtube.com/watch?v=7vw2iIdqHIM</a></li> <li>6. <a href="http://littlesvr.ca/dsa-html5-animations/sorting.php">http://littlesvr.ca/dsa-html5-animations/sorting.php</a></li> </ol>