

**213303**  
**Data Structures and Files**

<b>Credit Points</b>	<b>Teaching Hrs/Week</b>	<b>Practical Hrs/Week</b>
05	3	4

<b>Objective</b>	<ul style="list-style-type: none"> <li>▪ To understand the specifications and implementations of standard data structures and be able to select appropriate structures in developing programs.</li> <li>▪ To develop programs using different problem-solving approaches, and be able to recognize when a particular approach is most useful.</li> <li>▪ To be able to design and implement a program to model a real-world system, and subsequently analyze its behavior.</li> </ul>
<b>Prerequisites</b>	<ul style="list-style-type: none"> <li>▪ Knowledge of Computer Fundamentals and Programming</li> </ul>

<b>Unit</b>	<b>Topic Name</b>	<b>Details</b>	<b>Hrs</b>
<b>I</b>	<b>Fundamentals of Data structures</b>	<p><b>Fundamental Concepts</b> Introduction to Data Structures: Data, Data objects, data types, Abstract Data types (ADT) and Data Structure, Concept of Primitive and non primitive, Linear and Non-linear, static and dynamic, persistent and ephemeral data structures</p> <p><b>Linear Data Structures using Sequential Organization</b> Storage representation of array (row major and column major). Concept of ordered list and polynomial representation using arrays. Representation of sparse matrix, addition, transpose and fast transpose of sparse matrix, Time and space complexity analysis for simple and fast transpose for sparse matrix.</p>	05
<b>II</b>	<b>Stacks and Queues</b>	<p>Fundamentals stack &amp; queue as ADT, Representation and Implementation of stack / queue using arrays, Applications of stack / queue examples. Recursion: Definition, How Recursion works?</p> <p>Doubly Ended Queue, Priority queue</p>	08
<b>III</b>	<b>Searching and Sorting</b>	<p>Searching: Sequential, binary and Index sequential search.</p> <p>Sorting: General concepts: sort order, sort stability, efficiency and passes, Bubble sort, Quick sort, Merge sort.</p>	08
<b>IV</b>	<b>Linked Lists</b>	<p>Concept of linked organization, Singly linked list, Operations such as Insertion, deletion, circular linked list, doubly linked list, Garbage collection and Compaction.</p>	10

<b>V</b>	<b>Trees and Graphs</b>	Trees and binary trees-concept and terminology, Data structures for binary trees, Algorithm for tree traversals, Conversion of general tree to binary tree. Binary search trees. Graphs: Representation of graph - Adjacency matrix and Adjacency list, Graph traversals	10
<b>VI</b>	<b>Files</b>	Organization of files: sequential and direct access file, hashing function and it's characteristics, collision resolution, linear probing, chaining with and without replacement, rehashing, simple Index file	06

### Lab/ Term Work

Term work shall consist of a record in the form of a journal consisting of **8** assignments set by the lab in-charge and **one mini project** which will be done in a **group of 4-6 students**. Sample list is given below. However staff members may modify them and produce a varied list of programs based on the sample list if required. For each of the following programs, student should write an **algorithm and only then code the program (follow in-charge's instruction)**. The student has to take the **printout of the programs along with the input/output**.

#### List of Lab Assignment

**Lab 1:** Write a C program that uses functions to perform the following operations on singly linked list :-

- ✓ Creation
- ✓ Insertion
- ✓ Deletion
- ✓ Traversal

**Lab 2:** Write a C program that uses functions to perform the following operations on doubly linked list:-

- ✓ Creation
- ✓ Insertion
- ✓ Deletion
- ✓ Traversal in both ways

**Lab 3:** Write C programs that implement stack (its operation) using

- ✓ Arrays
- ✓ Pointers

**Lab 4:** Write C programs that implement Queue (its operation) using

- ✓ Arrays
- ✓ Pointers

**Lab 5:** Write a C program that uses stack operations to perform following

- ✓ Converting infix expression into postfix expression.
- ✓ Evaluating the postfix expression.

**Lab 6:** Write a C program that uses functions to perform the following

- ✓ Creating a Binary Tree of integers
- ✓ Traversing the above binary tree in preorder, inorder and postorder

**Lab 7:** Write a C programs that use both recursive & non-recursive functions to perform the following searching operations for a key value in a given list of integers

- ✓ Linear search
- ✓ Binary search

<p><b>Lab 8:</b> Write C programs that implement the following sorting methods to sort a given list of integers in ascending order.</p> <ul style="list-style-type: none"> <li>✓ Bubble sort</li> <li>✓ Quick sort</li> <li>✓ Merge sort</li> </ul>	
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Horowitz E., Sahani S., “Fundamentals of Data structures”, PHI</li> <li>2. Aho A., Hopcroft J., Ulman J., “Data Structures and Algorithms”, Pearson Education, 1998, ISBN-0-201-43578-0</li> <li>3. Balagurusamy E., “C and Data Structures”, Tata McGraw-Hill, 2003, ISBN 0 – 07 –053473 – X</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Langsam Y., Augenstein M., Tannenbaum A., “Data Structures using C and C++”, 2<sup>nd</sup> Edition, Prentice Hall of India, 2002, ISBN-81-203-1177-9</li> <li>2. Tremblay J., Soresan P., “An Introduction to Data Structures with Applications”, 2<sup>nd</sup> edition, Tata McGraw-Hill International Editions, 1984, ISBN-0-07-462471-7</li> <li>3. Horborn T., “File Concepts”</li> <li>4. Brassard G., Bratley P., “Fundamental of Algorithms”, PHI, 1999, ISBN 81 – 203 – 1131– 0</li> </ol>
<b>Related Websites</b>	<ol style="list-style-type: none"> <li>a. <a href="http://www.suite101.com/reference/data_structure_tutorial">www.suite101.com/reference/data_structure_tutorial</a></li> <li>b. <a href="http://www.cplusplus.com/doc/tutorial/structures">www.cplusplus.com/doc/tutorial/structures</a></li> <li>c. <a href="http://maxotek.net/blog/data-structure-tutorial-lesson-1-role-of-algorithms-and-data-structure-in-problem-solving-t146.html">maxotek.net/blog/data-structure-tutorial-lesson-1-role-of-algorithms-and-data-structure-in-problem-solving-t146.html</a></li> <li>d. <a href="http://www.owl.net.rice.edu/~comp320/2007/html/tutorials/tut04/">www.owl.net.rice.edu/~comp320/2007/html/tutorials/tut04/</a></li> <li>5. warrior <a href="http://-101.tripod.com/dstut/dstut.htm">-101.tripod.com/dstut/dstut.htm</a></li> </ol>

<b>Examination Scheme</b>	<b>Internal Assessment – 30 marks</b>	Quiz / Surprise tests + Assignments
	<b>Term Work-50 marks</b>	Continuous Assessment of Performance in the Laboratory, Journal, Viva, Lab Exam
	<b>Final Theory Paper – 45 marks</b>	Written