COURSE TITLE	**DATA STRUCTURE USING C++**
COURSE CODE	**01CT0308**
COURSE CREDITS	**4**

Objective:

1 The objective is this course is to teach efficient storage mechanisms of data for an easy access and to design and implementation of various basic and advanced data structures. Further, this course introduces various techniques for representation of the data in the real world and helps in designing and developing application using efficient data structures for protection and management of data and improving the logical ability.

Course Outcomes: After completion of this course, student will be able to:

1 Implement Object oriented concepts in C++.

2 Differentiate linear and non-linear data structures like stacks, queues, linked list etc

3 Choose appropriate data structure as applied to specified problem definition

4 Demonstrate operations like searching, insertion, deletion, traversing mechanism etc. on various data structures through programming

5 Select appropriate sorting and searching algorithm based on problem definition in order to get optimum solution

6 Compare and contrast the benefits of dynamic and static data structures implementations

Pre-requisite of course: Basic knowledge of C Language, Object Oriented Concepts

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction of C++** Introduction, Data types, Expression and control statements, Iteration statements in C++, Arrays and String, Functions, Structures, Class, Object, Friend Function, Static variables and Functions in class, Constructors and Destructors, Inheritance in C++, Types of Inheritance, Pointers, Virtual Functions, Polymorphism, Abstract classes, Templates in C++, Exception Handling in C++	8
2	**Linked List** Linked List as an ADT, Linked List Vs. Arrays, Memory Allocation & De-allocation for a Linked List, Linked List operations, Types of Linked List, Implementation of Linked List, Application of Linked List, polynomial, sparse matrix	8

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Contents : Unit	Topics	Contact Hours
3	**Stack** The Stack as an ADT, Stack operation, Array Representation of Stack, Link Representation of Stack, Application of stack – Recursion, Polish Notation	4
4	**Queues** The Queue as an ADT, Queue operation, Array Representation of Queue, Linked Representation of Queue, Circular Queue, Priority Queue, & Dequeue, Application of Queues – Johnsons Algorithm, Simulation	4
5	**Trees** Basic trees concept, Binary tree representation, Binary tree operation, Binary tree traversal, Binary search tree (BST) implementation, Thread Binary tree, The Huffman Algorithm, Expression tree, Introduction to Multiway search tree and its creation (AVL, B-tree, B+ tree), AVL tree balancing, B-tree, Application of trees.	6
6	**Graphs** Basic concepts, Graph Representation, Basic concepts, Graph Representation, Graph traversal DFS, Graph traversal BFS	4
7	**Sorting** Sort Concept, Shell Sort, Radix sort, Insertion Sort, Quick Sort, Merge sort, Heap Sort	4
8	**Serching** List Search, Linear Index Search, Index Sequential Search, Hashed List Search, Hashing Methods, Collision Resolution (One way and Two way)	4
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Lab Experiment - 01** Implementation of different operations on linked list – copy, concatenate, split, reverse, count no. of nodes etc.	2
2	**Lab Experiment - 02** Implementation of polynomials operations (addition, subtraction) using Linked List	2
3	**Lab Experiment - 03** Implementations of stack menu driven program	2
4	**Lab Experiment - 04** Implementations of Infix to Postfix Transformation and its evaluation program.	2
5	**Lab Experiment - 05** Implementations of queue menu driven program	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
6	**Lab Experiment - 06** Implementation of Priority queue program.	2
7	**Lab Experiment - 07** Implementations of Binary Tree menu driven program	2
8	**Lab Experiment - 08** Implementation of Binary Tree Traversal program.	2
9	**Lab Experiment - 09** Implementations of Shell sort, Radix sort and Insertion sort menu driven program	2
10	**Lab Experiment - 10** Implementations of searching methods (Index Sequential, Interpolation Search) menu driven program	2
11	**Lab Experiment - 11** Implementations of Graph menu driven program (DFS & BSF)	2
12	**Lab Experiment - 12** Implementations of Huffman code construction.	2
13	**Lab Experiments** Implementations of Linked Lists menu driven program., Implementation of different operations on linked list – copy, concatenate, split, reverse, count no. of nodes etc., Implementation of polynomials operations (addition, subtraction) using Linked List., Implementations of stack menu driven program., Implementations of Infix to Postfix Transformation and its evaluation program., Implementations of queue menu driven program., Implementation of Priority queue program., Implementations of Binary Tree menu driven program., Implementation of Binary Tree Traversal program., Implementation of various operations on tree like – copying tree, mirroring a tree, counting the number of nodes in the tree, counting only leaf nodes in the tree., Implementations of Shell sort, Radix sort and Insertion sort menu driven program., Implementations of searching methods (Index Sequential, Interpolation Search) menu driven program., Implementations of Graph menu driven program (DFS & BSF)., Implementations of Huffman code construction.	28
14	**Lab Experiment - 13** Implementations of Linked Lists menu driven program.	2
15	**Lab Experiment - 14** Representation of Sparse matrix using multilinked structure. Implementation of sparse matrix multiplication.	2
16	**Lab Experiment - 15** Implementations of Linked Lists menu driven program (stack and queue).	2
17	**Lab Experiment - 16** Implementations of Double ended queue using Linked Lists.	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
18	**Lab Experiment - 17** Implementation of Priority queue program using Linked Lists.	2
19	**Lab Experiment - 18** Implementation of multitask in one array.	2
20	**Lab Experiment - 19** Simulation of recursion.	2
21	**Lab Experiment - 20** Implementations of circular queue menu driven program.	2
22	**Lab Experiment - 21** Implementations of double ended queue menu driven program.	2
23	**Lab Experiment - 22** Implementation of Johnsons Algorithm.	2
24	**Lab Experiment - 23** Implementation of Simulation Problem.	2
25	**Lab Experiment - 24** Implementation of construction of expression tree using postfix expression.	2
26	**Lab Experiment - 25** Implementations of BST program.	2
27	**Lab Experiment - 26** Implementation of various operations on tree like – copying tree, mirroring a tree, counting the number of nodes in the tree, counting only leaf nodes in the tree.	2
28	**Lab Experiment - 27** Implementations of B-tree menu driven program.	2
29	**Lab Experiment - 29** Implementations of B+ tree program.	2
30	**Lab Experiment - 30** Implementation of Preorder traversal of a threaded binary tree.	2
31	**Lab Experiment - 31** Implementations of AVL Tree menu driven program.	2
32	**Lab Experiment - 32** Implementations of Quick Sort, Merge sort and Heap Sort menu driven program.	2
33	**Lab Experiment - 33** Implementations of Graph menu driven program (DFS & BSF).	2
34	**Lab Experiment - 34** Implementation of hashing functions with different collision resolution techniques.	2
Total Hours		**94**

Textbook :

1 Data Structures, Algorithms and Applications in C++, Sartaj Sahani, Silicon Press, 2004

References:

1 Data structures and Algorithms in C++, Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount , John Wiley and Sons, 2011

2 Introduction to Data Structure and its Applications, Introduction to Data Structure and its Applications, Jean-Paul Tremblay, P. G. Sorenson, McGraw Hill Education (India) Pvt. Ltd., 1984

3 Data Structures Using C & C++, Data Structures Using C & C++, Rajesh K. Shukla, Wiley- India, 2019

4 Data Structures, Data Structures, GAV PAI, Schaum's Outlines, 2014

5 Object Oriented Programming with C++, Object Oriented Programming with C++, E.Balaguruswamy, TMH, 2013

6 C++: The Complete Reference, C++: The Complete Reference, Schildt, McGraw-Hill Education (India), 2017

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
15.00	20.00	25.00	15.00	15.00	10.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc. for effective teaching.

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

3 Practical examination will be conducted at the end of the semester for evaluation of performance of students in laboratory.

4 Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.

Supplementary Resources:

1 http://www.nptelvideos.in/2012/11/programming-and-data-structure.html

2 http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

3 http://www.geeksforgeeks.org/data-structures/

4 https://www.hackerrank.com/domains/data-structures/arrays

5 https://www.docdroid.net/ZPfHmS5/data-structures-and-algorithms-narasimha-karumanchi-pdf

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