Kadi Sarva Vishwavidyalaya

Faculty of Engineering & Technology

Second Year Bachelor of Engineering (CE/IT) – Semester III

(With effect from: Academic Year 2018-19)

Subject Code: CT303-N	**Subject Title:** Data Structures & Algorithms
Pre-requisite	CC103-N: Fundamental of Programming

Teaching scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hours	Hours	Hours	Hours		Hours	Marks	Marks	Marks	Marks	Marks
04	00	02	06	05	03	70	30	20	30	150

Course Objective:

The learning objectives of the course are:

- to introduce the fundamentals of data structures, abstract concepts and how these concepts are useful in problem solving.
- to learn to develop algorithms and step by step approach to solve various problems.
- to understand and implement various data structures viz. stack, queues, linked lists, trees and graphs.
- to learn applications of each of the data structures.
- to distinguish different data structures and identify the suitable data structure required for given real world application.
- to understand various searching & sorting techniques to be applied on data structures.

Outline Of the Course:

Sr. No	Title of the Unit	Minimum Hours
1	Introduction	04
2	Linear Data Structures	18
3	Nonlinear Data Structures	18
4	Sorting and searching	12
5	Hashing	06
6	File Structures	06
	Total	**64**

Total hours (Theory): 64
Total hours (Lab): 32
Total hours: 96

Detailed Syllabus

Sr. No	Topic	Lecture Hours	Weightage(%)
1	**Introduction:** Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Data Management concepts, Types of Data structures, Data types– primitive and non-primitive	4	10
2	**Linear Data Structures:** Array: Representation of arrays, elementary string operations, Applications o f arrays, sparse matrix and its representation. Stack: Stack-Definitions &Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And their Compilation, Recursion, Tower of Hanoi. Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue, Linked List: Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.	18	25
3	**Non linear Data Structures**: Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal(In order, post order, preorder), Threaded binary tree, Binary search trees,Conversion of General Trees To Binary Trees, Applications Of Trees-Some balanced tree mechanism, eg.AVL trees, 2-3 trees, Height Balanced, Weight Balance, B-tree. Graph-Matrix Representation Of Graphs, Elementary Graph operations (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree).	18	25
4	**Sorting And Searching:** Insertion Sort, Bubble sort, Selection sort , Quick Sort,Merge Sort,Heap Sort, Linear Search, Binary Search.	12	20
5	**Hashing:** Hashing: The symbol table, Hashing Functions, Collision-Resolution Technique	6	10
6	**File Structures:** File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/RandomFile Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods.	6	10
	Total	64	100

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

Learning Outcome:

On successful completion of the course, the student will:

- be able to check the correctness of algorithms using inductive proofs and loop invariants.
- be able to learn fundamentals and operations of various linear and non-linear data structures, their applicability and comparisons.
- become familiar with a variety of sorting algorithms and their performance characteristics and be able to choose the best one under variety of requirements.
- be able to understand and identify the performance characteristics of fundamental algorithms and data structures and be able to trace their operations for problems such as sorting, searching, selection, operations on numbers, polynomials and matrices, and graphs.
- be able to analyze and select the appropriate data structure for managing and manipulating data for numerous real world applications

E-Resources:

- http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
- https://www.cs.princeton.edu/courses/archive/spr11/cos217/lectures/08DsAlg.pdf
- https://lecturenotes.in/materials/11971-data-structure-using-c?utm_source=subjectpage&utm_medium=web&utm_campaign=materialpage
- https://www.slideshare.net/vigneras/data-structures-and-algorithms

Reference Books:

1. An Introduction to Data Structures with Applications by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
2. Data Structures using C & C++ by Yedidyah Langsam Moshe J Augenstein Aaron M. Tenenbaum, PHI
3. Classic Data Structures by Debasis Samanta, PHI Learning
4. Fundamentals of Computer Algorithms by Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran Computer Science Press
5. Data Structures: A Pseudo-code approach with C++ by Richard Gilberg, Behrouz A. Forouzan, Cengage Learning

List of experiments:

Sr. No.	Name of Experiment
1	Write a menu driven program to perform the following operations on the **STACK** using an array. 1. Push 2. Pop 3. Peep 4. Change 5. Display the contents 6. Exit
2	Write a program to convert an infix expression into reverse polish (postfix) notation with parenthesis.
3	Write a program to solve the problem of Tower of Hanoi (Application of stack)
4	Write a menu driven program to perform the following operations on the **QUEUE** using an array. 1. Insert 2. Delete 3. Search 4. Change 5. Display the contents 6. Exit
5	Write a menu driven program to perform the following operations on the **CIRCULARQUEUE** using an array. 1. Insert 2. Delete 3. Search 4. Change 5. Display the contents 6. Exit
6	Write a menu driven program to perform the following operations on a **Singly Linked list**. 1. Insert 6. Search 2. Insend 7. Sort 3. Insat 8. Count 4. Delete 9. Display 5. Reverse 10. Exit
7	Write a menu driven program to perform the following operations on a **Doubly Linked list**.1. Insert 2. Insend 3. Insat 4. Delete 5. Display 6. Exit
8	Write a program to implement Searching Algorithms 1. Sequential search 2. Binary search
9	Write a program to implement following sorting algorithms • Selection sort • Bubble sort • Merge sort • Quick sort
10	Write a program to implement breadth first search (BFS) graph traversal algorithm.
11	Write a program to implement depth first search (DFS) graph traversal algorithm.
	As part of experimentation, a small project / model / seminar / poster / other should be prepared / presented by student(s) based on the practical knowledge gained by this course at the end of the curriculum. The concerned laboratory faculty (in consultation with course coordinator) is empowered to design/decide the type/execution of this experiment. The student(s) are expected to present the same before their batch-mates.