# Faculty of Computer Science & Applications
## Bachelor of Computer Applications in Data Science
## (W. E. F.: 2023-24)
**Document ID: SUTEFCAB-01**

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| **Name of Faculty** | : | Faculty of Computer Science & Applications |
| **Name of Program** | : | Bachelor of Computer Applications in Data Science |
| **Course Code** | : | 2BCA02 |
| **Course Title** | : | Data Structure |
| **Type of Course** | : | Professional Core |
| **Year of Introduction** | : | 2023-24 |

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|---|---|---|
| **Prerequisite** | : | Basic of 'c' Programming |
| **Course Objective** | : | To understand rate of change, Difference between Permutation and combination, to understand the geometric representation of any objects which are related, |
| **Course Outcomes** | : | At the end of this course, students will be able to: |
| | CO 1 | Define and classify various data structures, storage structures and common operations on them |
| | CO 2 | Create various linear data structures with their representation and perform different operations on them |
| | CO 3 | Create various nonlinear data structures with their representation and perform different operations on them |
| | CO 4 | Apply various searching sorting techniques on data set. |

**Teaching and Examination Scheme**

| Teaching Scheme (Contact Hours) | | | Credits | Examination Marks | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | Total Marks |
| **L** | **T** | **P** | **C** | **SEE** | **CIA** | **SEE** | **CIA** | |
| 3 | 0 | 2 | 4 | 50 | 25 | 50 | 25 | 150 |

*Legends: **L**-Lecture; **T**–Tutorial/Teacher Guided Theory Practice; **P**–Practical, **C** – Credit, **SEE** – Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars /Presentations/MCQ Tests, etc.))*

**Course Content**

| Unit No. | Topics | Hrs. | Weightage | Mapping with CO |
|---|---|---|---|---|
| 1 | **Introduction to Data Structures:** Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity of Algorithm,<br>Introduction and Definition of Data Structure, Classification of Data, Various types of Data Structure. | 8 | 20% | CO 1 |
| 2 | **Linear Data Structure: Array-** Introduction to Arrays, Definition, One Dimensional Array and Multidimensional Arrays, Representation of arrays, Applications of arrays, sparse matrix, and its representation<br>**Stack:** Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi<br>**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 | 15 | 25% | CO 2 |
| 3 | **Nonlinear Data Structure**: **Tree-** Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Trees To Binary Trees, Applications Of Trees, Some balanced tree mechanism, e.g. AVL trees, 2-3 trees, Height Balanced, Weight Balance, Graph-Matrix Representation Of Graphs, Elementary Graph operations, (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree)<br>**Graphs:** Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms. | 10 | 25% | CO 3 |
| 4 | **Searching, Sorting and Hashing: Searching and Sorting-**Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort.<br>**Hashing:** Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique (CRT), Perfect Hashing | 12 | 30% | CO 4 |

| Suggested Distribution of Theory Marks Using Bloom's Taxonomy | | | | | | |
|---|---|---|---|---|---|---|
| **Level** | Remembrance | Understanding | Application | Analyse | Evaluate | Create |
| **Weightage** | **30** | **40** | **30** | **-** | **-** | **-** |

*NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.*

**Suggested List of Experiments/Tutorials**

| Sr. No. | Name of Experiment/Tutorial | Teaching Hours |
|---|---|---|
| 1 | Write a C program that uses functions to perform:<br>**a)** Create a singly linked list of integers.<br>**b)** Delete a given integer from the above linked list.<br>**c)** Display the contents of the above list after deletion | 4 |
| 2 | Write a C program that uses functions to perform:<br>**a)** Create a doubly linked list of integers.<br>**b)** Delete a given integer from the above doubly linked list.<br>**c)** Display the contents of the above list after deletion. | 4 |
| 3 | Write a C program that uses stack operations to convert a given infix expression into its postfix equivalent. Implement the stack using an array. | 4 |
| 4 | Write C programs to implement a double ended queue ADT using: array and doubly linked list respectively. | 4 |
| 5 | Write a C program that uses functions to perform the following:<br>**a)** Create a binary search tree of characters.<br>**b)** Traverse the above Binary search tree recursively in Postorder. | 4 |
| 6 | Write a C program that uses functions to perform the following:<br>**a)** Create a binary search tree of integers.<br>**b)** Traverse the above Binary search tree non recursively in Inorder. | 4 |
| 7 | Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:<br>**a)** Insertion sort<br>**b)** Merge sort | 4 |
| 8 | Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:<br>**a)** Quick sort<br>**b)** Selection sort | 4 |
| 9 | Write a C program:<br>**i)** to perform operation Insertion into a B-tree<br>**ii)** for implementing Heap sort algorithm for sorting, a given list of integers in ascending order | 4 |
| 10 | Write a C program to implement all the functions of a dictionary (ADT) using hashing. | 4 |
| 11 | Write a C program for implementing Knuth-Morris- Pratt pattern matching algorithm. | 4 |
| 12 | Write C programs for implementing the following graph traversal algorithms: Depth first traversal & Breadth first traversal | 4 |

**Major Equipment/ Instruments and Software Required**

| Sr. No. | Name of Major Equipment/ Instruments and Software |
|---|---|
| 1 | DEV C++ |
| 2 | Microsoft C |
| 3 | Turbo C |

**Suggested Learning Websites**

| Sr. No. | Name of Website |
|---|---|
| 1 | https://www.tutorialspoint.com/data_structures_algorithms/data_structures_algorithms_tutorial.pdf |

**Textbook**

| Sr. No. | Name of Textbooks |
|---|---|
| 1 | Gilberg and Forouzan, "Data Structure- A Pseudo code approach with C" , Thomson publication |
| 2 | Tanenbaum, "Data structure in C", PHI / Pearson publication. |
| 3 | Pai, "Data Structures & Algorithms; Concepts, Techniques & Algorithms, Tata McGraw Hill |

**Reference books**

| Sr. No. | Name of Reference Books |
|---|---|
| 1 | Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, Tata McGraw Hill. |
| 2 | Ten Baum, Data Structures using C & C++, Prenctice-Hall International. |
| 3 | Horowitz, Sahni, Fundamentals of Computer Algorithms, Galgotia Pub. 2001 ed. |