SEMESTER-III

St. Xavier's College (Autonomous), Ahmedabad

Syllabus of Semester – III of the following departments under Faculty of Computer Science based on Undergraduate Curriculum Framework to be implemented from the Academic Year 2025-26.

DEPARTMENT OF COMPUTER SCIENCE

Major Course – 1: Data Structures (theory)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Pre-Requisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Data Structures (theory) (BCAMC111C)	4	0	0	10 + 2 from a recognized board in any stream	Nil

Course Outcomes:

At the end of the course, a student will be able to:

- Acquire the basic understanding and working of Data Structures
- Discuss the concept of the Array, Linked list and various algorithms for data structure.
- Clarify the concept of the Searching, Sorting and various algorithms for data structure
- Acquire the basic understanding and working idea of the stack, operations of the Stack with algorithm and Explanation
- Acquire the basic understanding and working idea of the queue, types of queue, operations with Algorithm and Explanation
- Clarify the concept of the tree, terminology, binary tree definition, representation of binary tree, operations on binary tree, types of binary tree with Algorithm and Explanation
- Distinguish the concept of the graph, basic terminology, representation of graphs, adjacency Matrix (Array), adjacency linked, traversal of the graph, application of graph, spanning tree with Algorithm and Explanation

UNIT 1 Introduction to Data Structures, Arrays & Linked List Introduction:

- Data
- Data Types
- Abstract Data Types (Primitive)
- User- Defined Data Types (Non-Primitive)
- Data Structures: Definition
- Classification of Data Structures and details of each classifications

Array

- Definition

- Mapping
- Sparse Matrix

Linked list

- Comparison of Array and Linked List,
- Types of Linked Lists
- Representation of Linked Lists Operations on Doubly Linked Lists (Algorithm and Explanation)
- Creation
- Traversal
- Insertion
    1. Front
    2. In Between (After and Before)
    3. At End
- Deletion
    1. From Beginning
    2. From Between
    3. From End

Searching:

- Introduction to Searching
- Searching Techniques
    1. Sequential Search
    2. Binary Search

Sorting

- Introduction to Sorting
- Sorting Technique
    1. Bubble sort
    2. Selection sort
    3. Insertion sort
    4. Quick sort
    5. Merge sort
    6.

UNIT 2 Stack & Queues

Stack

- Introduction (Idea of the Stack)
- Operations of the Stack (Algorithm and Explanation)
- Implementation of the Stack (Using linked list)
- Applications of the Stack
- Reverse and Polish Conversion: Infix to Postfix using manually and stack for parenthesis andNon-parenthesis (with Algorithm)
- Recursion(Definition)

Queue

- Introduction (Idea of the Queue)
- Types of Queue, Operations of Simple and Circular Queue

(Algorithm and Explanation), Implementation of the Queue (Using Linked list)

UNIT 3 Tree

- Introduction
- Terminology
- Binary Tree: Definition
- Representation of Binary Tree
- Operation on Binary Tree
- Creation, Insertion
- Deletion Traversal (Pre-Order, In-Order and Post-Order)
- Conversion from (Pre, Inor Post) into Binary Tree
- Types of Binary Tree
- Full Binary Tree Complete Binary Tree
- Binary Search Tree, Expression Tree
- Threaded Binary Tree
- Heap Tree
- Height Balanced Tree (AVL Tree)
- B-Tree

UNIT 4 Graph

- Introduction
- Basic Terminology
- Representation of Graph
- Adjacency Matrix (Array)
- Adjacency Linked, Traversal of Graph
- Breadth First Traversal (Algorithm and Tracing)
- Depth First Traversal (Algorithm and Tracing)
- Application of Graph
- Spanning Tree
- Minimum Spanning Tree (BFS and DFS)
- Prim's Algorithm
- Kruskal's Algorithm
- Shortest Path Algorithm
- Dijkstra's Algorithm

Text Book:

Data and File Structures using C Publisher: Oxford By Reema Thareja

- Chapter-4 (4.1, 4.2, 4.3) – Introduction to Data Structures
- Chapter-5 (5.1, 5.2, 5.3, 5.6.5, 5.16) – Array and Searching
- Chapter-8 (8.2, 8.7) – Linked List
- Chapter-9 (9.1, 9.3, 9.4, 9.5, 9.7, 9.8, 9.11, 9.12, 9.13, 9.14, 9.16*Only Definition+,9.17
    - *Definition and 9.17.1+) –Stack & Queues

- Chapter-10 (10.1, 10.2, 10.4*excluding 10.4.4+) - Tree
- Chapter-11 (11.1, 11.2.2, 11.2.3, 11.3, 11.4 *Definition and 11.4.2+, 11.6*Definition and 11.6.2+) - Tree
- Chapter-12 (12.1*Definition and 12.1.1, 12.1.2+) - Tree
- Chapter-13 (13.1, 13.4, 13.5, 13.7*excluding 13.7.5+) - Graph
- Chapter-14 (14.1, 14.2, 14.3, 14.4, 14.5, 14.6) – Sorting

Reference Books:

1. Data Structures and Algorithms in C++ Publisher: Dreamtech By B. M. Harvani
2. Magnifying Data Structures Publisher: PHI By: Arpita Gopal
3. Data Structures using C & C ++ Publisher: Wiley-India By : Rajesh K. Shukla
4. Introduction to Data Structures in C Publisher: Pearson Education By: Ashok N.Kamthane

Data Structures Using C Publisher: Pearson Education By : A. K Sharma

SEMESTER-III

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Syllabus of Semester – III of the following departments under Faculty of Computer Science based on Undergraduate Curriculum Framework to be implemented from the Academic Year 2025-26.

DEPARTMENT OF COMPUTER SCIENCE

Major Course – 2: Fundamentals of Operating System

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Pre-Requisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Fundamentals of operating system (BCAMC332C)	4	0	0	10 + 2 from a recognized board in any stream	Nil

Learning Objective:

Students would be able to

1) Recognize key elements of an Operating System.
2) Understand the basics of process management and memory management.
3) Know the concepts of I/O and file systems.
4) Outline the role and functionalities of OS components.

Learning Outcome:

By the end of this course, students will be able to:

1) Develop a fundamental understanding of operating systems and their core functions.
2) Comprehend process management concepts and explore different process scheduling algorithms.
3) Recognize the significance of process synchronization in enhancing system efficiency and apply deadlock handling techniques.
4) Gain knowledge of various memory management strategies used in operating systems.
5) Understand device management principles and analyse different seek strategies for efficient device handling.
6) Identify challenges related to file systems and implement security measures for system protection.

Introduction to Operating System & Memory Management

• **Introduction to Operating System**

o What is Operating System?

o Operating system software

o Types of Operating System

- **Memory Management**
  - Memory Management: Early System
    - Single User Contiguous Scheme
    - Fixed Partitions
    - Dynamic Partitions
    - Allocation and deallocation methods
    - Relocatable Dynamic Partitions
  - **Memory Management: Virtual Memory**
    - Paged Memory Allocation
    - Demand Paging
    - Page Replacement Algorithms
      - i. First In First Out
      - ii. Least Recently Used
    - Segmented Memory allocation
    - Segmented/Demand Paged Memory allocation
    - Virtual Memory

I **15**

CPU Management & Deadlock

II — **15**

- **Processor Management**
  - Job Scheduler, Process Scheduler,
  - Job and Process Status
  - Process Control Block
  - Process Scheduling Policies
  - Process Scheduling Algorithms:
    - First Come First Serve
    - Shortest Job Next
    - Priority Scheduling
    - Shortest Remaining Time
    - Round Robin
- **Deadlock**
  - Seven cases for dead lock
  - Conditions for Deadlock
  - Strategies for handling Deadlocks
  - Starvation (Dining Philosophers Problem)

Task Synchronization and Device Management

III — **15**

- **Process Synchronization**
  - What is parallel Processing?
  - Typical Multiprocessing configurations
  - Process Synchronization Software-test and set, Wait and Signal
  - Semaphores
  - Process Cooperation-Producers and consumers
- **Device Management**
  - Types of System Devices
  - Component of I/O subsystem
  - Brief overview of Communication among devices
  - Brief overview of management of I/O requests
  - Device Handler Seek Strategies
    - FCFS
    - SSTF
    - Elevator (Look)
  - RAID

File Management & Security

IV — **15**

- **File Management**
  - The File Manager
  - Interacting with the file manager
  - Typical Volume Configuration
  - About Subdirectories
  - File Organization
  - Physical storage allocation
  - Data Compression
  - Access Control Verification module

- **Security**
  - Role of the Operating System in Security
    - System Survivability (Only Definition)
    - Backup and Recovery
  - Security Breaches
    - Unintentional Intrusions
    - Intentional Attacks
  - System Protection
    - Antivirus Software
    - Firewalls
    - Encryption
    - Sniffers and Spoofing

Operating Systems

Text Book: Publication: Cengage learning

By Flynn/Mc Hoes

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DEPARTMENT OF COMPUTER SCIENCE

Major Course – 3: Data Structures using C++

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Pre-Requisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Data structures using C++ Practical (BCAMC333L)	0	0	8	10 + 2 from a recognized board in any stream	Nil

Unit	Topics	Hours
I	**Link List**	15

1. Write program to implement following operations using Singly link list
- Insert at first
- Insert at Last
- Insert at specified location (Before or After the Node)
- Delete from first
- Delete from last
- Delete any specified node
- Traversal
- Sorting
- Splitting
- Merging
- Counting Operations(Total no. of nodes, even and odd no. of nodes)

2. Write program to implement following operations using Doubly link list
- Insert at first
- Insert at Last
- Insert at specified location (Before or After the Node)
- Delete from first
- Delete from last
- Delete any specified node
- Traversal
- Sorting

• Splitting
• Merging

Counting Operations(Total no. of nodes, even and odd no. of nodes)

II	**Searching and Sorting**	15

1. Write a program to implement sequential search.
2. Write a program to implement binary search.
3. Write a program to implement bubble sort.
4. Write a program to implement selection sort
5. Write a program to implement merge sort
6. Write a program to implement quick sort

Write a program to implement insertion sort.

III	**Stack**	15

1. Write a program to implement following operations in stack Using Linked List.
   • PUSH
   • POP
   • PEEP
   • CHANGE
2. Write a program to implement Evaluation of given postfix expression.
3. Write a program to implement conversion of infix expression into postfix expression (parentheses and non-parentheses).
4. Write a program to implement recursion.

Write a program to reverse the string using the stack.

IV	**Queue, Tree and Graph.**	15

1. Write a program to implement Simple Queue operations using Linked List.
   • ENQUEUE
   • DEQUEUE
   • Traversal (display)
2. Write a program to implement Circular Queue operations Using Linked List.
   • ENQUEUE
   • DQUEUE
   • Traversal (display)
3. Write a program to implement following operations on Binary Search Tree using Linked List.
   • Creation
   • Insertion
   • Traversal(In-order, Pre-order, Post-order)
4. Write a program to implement following DFS and BFS traversal Of a graph.

Text Book:

1) Data and File Structures using C
   Publisher: Oxford By Reema Thareja

Reference Books:

1) Data Structures and Algorithms in C++
   Publisher: Dreamtech
   By B. M. Harvani
2) Magnifying Data Structures
   Publisher: PHI
   By: Arpita Gopal
3) Data Structures using C & C ++
   Publisher: Wiley-India
   By : Rajesh K. Shukla
4) Introduction to Data Structures in C
   Publisher: Pearson Education
   By: Ashok N. Kamthane
5) Data Structures Using C Publisher: Pearson Education By : A. K Sharma