

St. Xavier's College (Autonomous), Ahmedabad

Syllabus of Semester – III of the following departments under Faculty of Computer Science based on Under Graduate Curriculum Framework to be implemented from the Academic Year 2026-27.

DEPARTMENT OF COMPUTER SCIENCE

BSC IT (Hons.) Category – IV

Major Course – 1: Principles of Data Structures and Algorithm

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Prerequisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Principles of Data Structures and Algorithm ITMC331C	2	0	2	10 + 2 from a recognized board in any stream	Nil

Learning Objectives

To provide students with a fundamental understanding of data structures and their operations, enabling them to analyze, implement, and apply arrays, linked lists, stacks, queues, trees, and graphs along with searching, sorting, and traversal algorithms.

Learning Outcome

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

Syllabus of Major – 1 : Principles of Data Structures and Algorithm

UNIT - I Introduction to Data Structures, Arrays & Linked List 15 Hours

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

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

Implementation in C++:

- All sorting and searching techniques

UNIT - II Linked List, Stack & Queues 15 Hours

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

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 and Non-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)

Implementation in C++:

- Singly Linked List, Doubly linked list and Circular linked list.
- Stack
 - Queue

UNIT - III Tree

15 Hours

- 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, In or 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

Implementation in C++:

Binary Tree

UNIT - IV

Graph

15 Hours

- 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

Implementation

Graph

Essential / Recommended Readings:

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) – Sortin

Suggestive Readings:

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

Textbook:

Operating Systems
Publication: Cengage learning
By Flynn/Mc

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DEPARTMENT OF COMPUTER SCIENCE

BSC IT(Hons.) Category-IV

Major Course – 2: Foundations 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		
Foundations of Operating System ITMC332C	4	0	0	10 + 2 from a recognized board in any stream	Nil

Learning Outcomes:

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

- Acquire the basic understanding of the Operating system.
- Understand the concepts of process and various process Scheduling Algorithms.
- To appreciate the role of Process synchronization towards increasing throughput of system and apply various concept related with Deadlock for handling deadlock

Syllabus of Major – 2 Foundations of Operating System

UNIT - I Introduction to Operating System & Memory Management 15 HOURS

- **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

UNIT - II	CPU Management & Deadlock • 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)	15 HOURS
UNIT -III	Task Synchronization and Device Management • 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	15 HOURS
UNIT - IV	File Management & Security • File Management • The File Manager • Interacting with the file manager • Typical Volume Configuration • About Subdirectories • File Organization • Physical storage allocation	15 HOURS

- 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

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DEPARTMENT OF COMPUTER SCIENCE

BSCIT

Major Course 3: Computer Organization and Microprocessors and Indian Knowledge System

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course Title & Code	Credit Distribution of The Course			Eligibility Criteria	Prerequisite(s) of the Course (if any)
	Lecture	Tutorial	Practical / Practice		
Computer Organization and Microprocessors and Indian Knowledge System ITMC333L	4	0	0	UG Semester-2	Nil

Learning Objective:

The objective of the course is to make student aware about the basic structure of computer system, organization of main components inside the system, functions of these components, Boolean expression for digital logic, circuit design using logic gates, different integrated circuits (ICs), circuit design from truth table, data representation inside the processor following IEEE745 standard. It also gives ideas about various types of memories used in computer systems, their organizations and working patterns, architecture of 8086 microprocessors and latest microprocessors for computer systems as well as for mobile devices.

Learning Outcome:

After completing this course, student will be able to:

- Describe the internal architecture and organization of components in a computer system.
- Analyze functions of different components of computers.
- Demonstrate various types of digital circuits and their use.

- Create basic digital circuit using logic gates by applying Boolean algebraic expressions and truth tables. (On paper)
- Illustrate how computers store data internally using different arithmetic operations by following IEEE standard 754 for data representation.
- Categorize the various memory types and their working and arrangement in computer systems.
- Discuss microprocessor's working architecture and latest microprocessors for both computers and mobile.

Unit	Particulars	Hours
Unit 1	Indian Knowledge System: An Introduction	
	Indian Knowledge System	
	• Indian Knowledge System: An Overview • The Vedic Corpus • Philosophical Systems • Wisdom through the Ages	15
	Foundational Concepts for Science and Technology	
	• Science, Engineering and Technology in IKS • Linguistics • Number System and Units of Measurement • Knowledge: Framework and Classification	
Unit 2	Data Representation and Memory Organization	15
	Data Representation	
	• Signed and Unsigned Number Representation • Fixed Point Representation • 1's Complement and 2's Complement Representation • Floating Point Representation • Normalization • IEEE 754 Single Precision Representation	
	Memory Organization	
	• Memory Hierarchy • Memory Parameters • Main Memory Organization • Cache Memory: Principle, Cache Hit, Cache Miss • Cache Mapping Techniques (Direct, Associative, Set-Associative)	
	Memory Performance	
	• Access Time • Memory Cycle Time • Hit Ratio • Effective Memory Access Time	

Unit 3 Intel 8086 Microprocessor Organization

15

Memory Organization of 8086

- Memory Segmentation
- Segment Registers
- Logical Address and Physical Address
- Address Calculation
- Physical Memory Organization

Processor Operation

- General Bus Operation
- Signal Descriptions of 8086
- Minimum Mode Operation
- Maximum Mode Operation
- Special Processor Activities

8086 Instruction Set (Overview)

- Classification of Instructions
- Data Transfer Instructions
- Arithmetic Instructions
- Logical Instructions
- Branch Instructions
- String Instructions
- Flag Operations

Unit 4 Advanced Processor Concepts

15

Interrupts and Data Transfer

- Interrupt Structure of 8086
- Hardware and Software Interrupts
- Interrupt Vector Table
- Direct Memory Access (DMA)
- I/O Addressing Capability

Processor Evolution

- Evolution from 8085 to Modern Intel Processors
- Pentium Family
- Pipeline Processing (Introduction)
- Multi-core Processors

Modern Processor Architectures

- ARM Architecture (Introduction)
- Embedded Processors
- Mobile Processors and Their Applications
- Overview of AMD, MIPS and SPARC Architectures

Textbooks

Sr. No.	Title	Author(s)	Publisher
1	<i>Computer System Architecture</i>	Morris Mano	Pearson Education
2	<i>The Intel Microprocessors: Architecture, Programming and Interfacing</i>	Barry B. Brey	Pearson Education
3	<i>Mahadevan, B., Vinayak Rajat Bhat, and R.N. Nagendra Pavana, Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning Private Limited, New Delhi, 2022.</i>		

Reference Books

Sr. No.	Title	Author(s)	Publisher
1	<i>Computer Organization and Architecture</i>	William Stallings	Pearson Education
2	<i>Computer Organization and Embedded Systems</i>	Carl Hamacher, Zvonko Vranesic & Safwat Zaky	McGraw-Hill
3	<i>Advanced Microprocessors and Peripherals</i>	A. K. Ray & K. M. Bhurchandi	McGraw-Hill
4	<i>Microprocessors and Interfacing: Programming and Hardware</i>	Douglas V. Hall	McGraw-Hill

Knowledge System: Concepts and Applications, PHI Learning Private Limited, New Delhi, 2022.

Reference Books:

1) Advanced Microprocessors and Interfacing By: - Badri Ram Publisher: Tata Mcgraw Hill