LNCT UNIVERSITY, BHOPAL

Programme:- MCA (AIML) **Semester - I** **wef: July 2025**

Name of Paper	Paper Code	Theory					
		Credit			Marks		
		L	T	J	EST	CAT	Total
Data Structures	MAI-101	3	1	0	80	20	100

Course Objective	The objective of this course is to provide the students with concepts of data structures. To bring out the importance of data structures in a variety of applications.

Units	Contents (*Theory*)	Hours /week
	Pre-requisite: Arrays and Strings, Structure, Pointers, Dynamic memory allocation.	
I	**Stack and Queue:** Abstract Data Types (ADT), stack ADT, Operations and Applications of stack, array and linked list implementations of stack, Queue ADT, Types of Queue: Circular Queue, Priority Queue and Double Ended Queue, Operations and Applications of Queue, Array and Linked list implementations of Queue.	8
II	**Linked List:** List ADT, Singly linked list, Circular linked list, Doubly linked list, Various operations on Linked list, Implementation of linked list using array, Applications of linked list – Polynomial Manipulation.	8
III	**Trees:** Definition, Tree Terminologies, Binary Trees and its type: various theorems, Binary tree traversals, Applications of trees – Huffman Algorithm, Expression Tree, Threaded binary trees, Binary search tree, Operations on BST, Balanced Trees - AVL Tree, Splay Tree, Red Black Tree, M Way search trees- B-Tree ,B+ Tree, Forests, conversion of forest into tree. Heap- Heap operations and Applications: Binomial Heap and Fibonacci Heap.	8
IV	**Graph:** Introduction, Representation of graph, Graph Traversals - Depth-first and breadth first traversal, Applications of graphs - Topological sort, shortest-path algorithms - Dijkstra's algorithm, Bellman-Ford algorithm, Floyd Warshall's Algorithm, Minimum spanning tree – Prim's and Kruskal's Algorithms.	8
V	**Searching, Hashing and Sorting:** Requirements of a search algorithm; sequential search, binary search, indexed sequential search, interpolation search; hashing-basics, methods, collision, resolution of collision, chaining; Internal sorting- Bubble sort, selection sort, insertion sort, quick sort, merge sort on linked and contiguous list, shell sort, heap sort.	8

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Text Books/Reference Books:-			
Name of Authors	**Titles of the Book**	**Edition**	**Name of the Publisher**
Yashvant P Kanetkar	Let Us C	VII	BPB Publications, New Delhi.
YashwantKanetkar	Understanding Pointers in C	V	BPB
Kruse R.L	Data Structures and Program Design in C	II	PHI
Trembly	Introduction to Data Structure with Applications	IV	
TennenBaum A.M & others	Data Structures using C & C++	III	PHI

COURSE OUTCOMES: Students will be able to	
CO1	Implement stack and queue using C
CO2	Perform operations on single linked list and doubly linked list
CO3	Perform traversal, insertion and deletion operations on various types of trees.
CO4	Analyze Graph algorithms and its applications.
CO5	Implement various searching and sorting algorithms.

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Name of Paper	Paper Code	Theory					
		Credit			Marks		
Decoding Data: Learn AI, ML, DS & Analytics	**MAI-102**	**L**	**T**	**J**	**EST**	**CAT**	**Total**
		3	1	0	80	20	100

Course Objective	• To introduce the concepts of Data Science, Big Data, and the various types of data encountered in real-world scenarios. • To provide foundational knowledge of Machine Learning, its types, and commonly used algorithms. • To familiarize students with the fundamentals and historical background of Artificial Intelligence. • To equip students with basic data analysis skills using tools like Excel and Power BI. • To introduce the tools and frameworks used in the Big Data and Machine Learning ecosystem, including distributed systems and NoSQL databases.

Units	Contents (*Theory*)	Hours /week
I	**Introduction to Data Science:** Defining Data Science and Big Data, Benefits and Uses of Data Science and Big Data, Facets of Data, Structured Data, Unstructured Data, Natural Language, Machine generated Data, Graph based or Network Data, Audio, Image, Video, Streaming data, Data Science Process, Big data ecosystem and data science, distributed file systems, Distributed programming framework, data integration framework, machine learning framework, No SQL Databases, scheduling tools, benchmarking tools, system deployments	8
II	**Introduction to Machine Learning:** What is Machine Learning, Learning from Data, History of Machine Learning, Big Data for Machine Learning, Leveraging Machine Learning, Descriptive vs Predictive Analytics, Machine Learning and Statistics, Artificial Intelligence and Machine Learning	8
III	**Types of Machine Learning** – Supervised, Unsupervised, Semi-supervised, Reinforcement Learning, Types of Machine Learning Algorithms, Classification vs Regression Problem, Bayesian, Clustering, Decision Tree, Dimensionality Reduction, Neural Network and Deep Learning, Training machine learning systems	8
IV	**Introduction to AI:** What is AI, Turing test, cognitive modelling approach, law of thoughts, the relational agent approach, the underlying assumptions about intelligence, techniques required to solve AI problems, level of details required to model human intelligence, successfully building an intelligent problem, history of AI	8

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V	**Introduction to Data Analytics:** Working with Formula and Functions, Introduction to Power BI & Charts, Logical functions using Excel, Analysing Data with Excel.	8

Text Books/ReferenceBooks:-

Name of Authors	Titles of the Book	Edition	Name of the Publisher
McKinney, W.	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython	3rd	O'Reilly Media
James, G., Witten, D., Hastie, T., & Tibshirani, R.	An Introduction to Statistical Learning: With Applications in R	2nd	Springer
Grus, J.	Data Science from Scratch: First Principles with Python	2nd	O'Reilly Media

COURSE OUTCOMES: Students will be able to

CO1	Explain the fundamentals of Data Science, Big Data, and various data types.
CO2	Analyze and differentiate between types of Machine Learning and their applications.
CO3	Elaborate core concepts and history of Artificial Intelligence.
CO4	Apply data analysis techniques using Excel functions and Power BI tools.
CO5	Demonstrate the use of big data tools and machine learning frameworks in distributed systems.

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Name of Paper	Paper Code	Theory					
		Credit			Marks		
Computer Architecture & Operating System	MAI-103	L	T	J	EST	CAT	Total
		3	1	0	80	20	100

Course Objective	The main objective is to understand the concept of computer system and organization, memory management, and parallel processing concepts.

Units	Contents (*Theory*)	Hours /week
I	**Computer System:** Comparison of Computer Organization &Architecture, Computer Components and Functions. **Fundamentals of Digital Logic:** Boolean Algebra, Logic Gates, Simplification of Logic Circuits: Algebraic Simplification, Karnaugh Maps. Combinational Circuits: Adders, Multiplexer & De-Multiplexer, Sequential Circuits: Flip-Flops (SR, JK & D), Counters. **Memory System Organization:** Classification and design parameters, Internal Memory, Interleaved and Associative Memory, Cache Memory, Memory mappings, Replacement Algorithms, Virtual Memory, External Memory, Direct Memory Access.	8
II	**CPU Organization**: CPU Building Blocks, CPU Registers and BUS Characteristics, Registers and System Bus Characteristics; Instruction Format; Addressing Modes; Interrupts: Concepts and types; Instruction and Execution Interrupt cycle; Hardwired and Micro Program control; Introduction to RISC and CISC **Multi-Processor Organization:** Parallel Processing, Concept and Block Diagram, Types (SISD, SIMD, Interconnect network, MIMD, MISD), Future Directions for Parallel Processors, Performance of Processors **Pipelining**: Data Path, Time Space Diagram, Hazards. Instruction Pipelining, Arithmetic Pipelining	8
III	**Operating system concepts:** OS definition and services; Types and features: System Calls types, System Programs **Process vs. Thread:** Process states, process control block; inter-process communication; Process Synchronization: Classical problems of synchronization; CPU Scheduling: Criteria; Algorithms: FCFS, SJF, Priority, Round- Robin, Critical section problem and solution criteria, Semaphores.	8
IV	**Memory Management:** Paging and Segmentation approaches, Virtual memory, Demand Paging and Page Replacement algorithms; Deadlocks: necessary conditions, prevention, avoidance and recovery, Banker's algorithm	8

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V	**File Management:** File system Structure, allocation methods: Contiguous allocation, Linked allocation, indexed allocation: free space management: Bit vector, linked list, grouping, counting: Directory implementation: Linear List, Hash table. Device Management: Disk structure, Disk scheduling:, Selecting Disk Scheduling algorithm.	8

Text Books/Reference Books:-

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Dr. Tarun Varma, Dr. Lakshmi Narayan Gahalod, Prof. Shradhha Shrivastava	Exploring Computer Organization and Architecture (Foundation of Digital Design and Codes)	1st	Notion Press
M. Morris Mano, edition	Computer System Architecture	3rd	PHI
Pal Chaudhary	Computer Organisation and architecture	3rd	PHI
Tanenbaum	Structured computer organization-	6th	Pearson
A. Silberschatz, Galvin	Operating System Concepts	8th	
Andrew S Tanenbaum, ,	Modern Operating Systems	3rd	Pearson Education
J. Archer Harris	Schaum's Outline of Operating Systems	1st	McGraw-Hill
William Stallings	Operating System	8th	Pearson Education.

COURSE OUTCOMES: Students will be able to

CO1	Illustrate the fundamental organization of a computer system, addressing modes, and instruction formats with memory hierarchies.
CO2	Relate and understand various addressing modes also explain parallel processing concepts.
CO3	Appraise multiprogramming and multitasking with CPU Scheduling algorithms and Synchronization.
CO4	Take apart concepts of paging, segmentation and dead lock situation with Hash table and disk scheduling algorithms.
CO5	Write organizing, accessing, manipulating, and securing files and directories across different operating systems."

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Name of Paper	Paper Code	Theory					
		Credit			Marks		
		L	T	J	EST	CAT	Total
Software Engineering Methodologies and UML	MAI-104	3	1	0	80	20	100

Course Objective	To understand the software engineering methodologies involved in the phases of project development and study of the problem identify project scope, objectives and infrastructure.

Units	Contents (*Theory*)	Hours /week
I	Software Engineering paradigms – Waterfall Life cycle model – Spiral Model – Prototype Model– Software Requirement - Requirements Elicitation Techniques – Initial Requirements Document — SRS Document – Requirements Change Management - Project Management.	8
II	Software Design Abstraction – Modularity – Software Architecture – Cohesion – Coupling – Various Design Concepts and notations – Development of Detailed Design & Creation of Software Design Document - Dataflow Oriented design – Designing for reuse – Programming standards.	8
III	Scope – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Reliability – Software Quality Assurance – Standards. Need of Software Estimation – Function Point – Risk Management.	8
IV	Software Testing Fundamentals – Software testing strategies – Black Box Testing – White Box Testing – System Testing – Functional Testing – Structural Testing – Regression Testing - Testing Tools – Test Case Management – Challenges of Software Maintenance – Types of Maintenance. Software Maintenance Organization – Maintenance Report.	8
V	Introduction to UML: Use Case Approach,: Identification of Classes and Relationships, Identifying State and Behavior, Use Case Diagram Class Diagram – State Diagram - Sequence ‘Diagram – Activity Diagram – Deployment Diagrams Case Study – LMS.	8

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Text Books/ ReferenceBooks:-			
Name of Authors	**Titles of the Book**	**Edition**	**Name of the Publisher**
R. S. Pressman	Software Engineering – A practitioner's approach	VI	McGraw Hill
Pankaj Jalote	Software Engg	IV	Narosa Publications
Ian Sommerville	Software Engineering 6/e	VI	Addison-Wesley

COURSE OUTCOMES: Students will be able to	
CO1	Summarize software process models, software requirements and the SRS documents.
CO2	Write software design approaches.
CO3	Reframe software measurement and software risks.
CO4	Rewrite software testing approaches.
CO5	Illustrate UML to model software solutions, application structures, system behavior and business processes.

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Name of Paper	Paper Code	Theory					
		Credit			Marks		
		L	T	J	EST	CAT	Total
Data Analysis Using Python	**MAI-105**	3	1	0	80	20	100

Course Objective	• Understand the Python programming environment, syntax, and basic control flow. • Learn to work with Python data structures, functions, and file operations. • Apply NumPy for efficient array and matrix computations. • Perform data manipulation and analysis using pandas. • Create informative and customizable visualizations using matplotlib and seaborn

Units	Contents (*Theory*)	Hours /week
I	**Python programming Basic:** Python interpreter, IPython Basics, Tab completion, Introspection, %run command, magic commands, matplotlib integration, python programming, language semantics, scalar types. Control flow.	8
II	**Data Structure, functions, files:** tuple, list, built-in sequence function, dict, set, functions, namescape, scope, local function, returning multiple values, functions are objects, lambda functions, error and exception handling, file and operation systems	8
III	**NumPy: Array and vectorized computation:** Multidimensional array object. Creating ndarrays, arithmetic with numpy array, basic indexing and slicing, Boolean indexing, transposing array and swapping axes, universal functions, array-oriented programming with arrays, conditional logic as arrays operations, file input and output with array	8
IV	**Pandas:** Pandas data structure, series, DataFrame, Index Object, Reindexing, dropping entities from an axis, indexing, selection and filtering, integer indexes, arithmetic and data alignment, function application and mapping, soring and ranking, correlation and covariance, unique values, values controls and membership, reading and writing data in text format	8
V	**Visualization with Matplotlib:** Figures and subplots, colors, markers, line style, ticks, labels, legends, annotation and drawing on sublots, matplotlib configuration. **Plotting with pandas and seaborn:** line plots, bar plots, histogram, density plots, scatter and point plots, facet grids and categorical data	8

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Text Books/Reference Books:-			
Name of Authors	**Titles of the Book**	**Edition**	**Name of the Publisher**
Wes McKinney	Python for Data Analysis	3rd	O'Reilly Media
Mark Lutz	Learning Python	5th	O'Reilly Media
Ivan Idris	NumPy Beginner's Guide	3rd	Packt Publishing
Luciano Ramalho	Fluent Python	2nd	O'Reilly Media
Allen B. Downey	Think Python	2nd	Green Tea Press

COURSE OUTCOMES: Students will be able to	
CO1	Describe the Python interpreter, control flow, and basic syntax.
CO2	Use built-in data structures, functions, and manage file I/O and exceptions.
CO3	Implement data processing using NumPy arrays and functions.
CO4	Analyze and manipulate structured data using pandas.
CO5	Visualize data using matplotlib and seaborn plotting libraries.

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Name of Paper	Paper Code	Practical				
		Credit		Marks		
		P	J	ESP	CAP	Total
Lab in Data Structure	MAI-106	8	0	120	80	200

Content: -

1. **C Programming Review**: Recap basic C syntax, functions, arrays, pointers, and structures.

2. **Stack:-**

- Implementing stack using arrays and linked lists.
- Operations: push, pop, peek.
- Exercises: evaluate postfix expressions, implement stack-based algorithms (e.g., parentheses matching).

3. **Queues:-**

- Implementing queue using arrays and linked lists.
- Operations: enqueue, dequeue, peek.
- Exercises: Linear Queue, Circular Queues, Priority Queues.

4. **Linked Lists:-**

- Implementing Multiple type of linked lists.
- Operations: insertion, deletion, traversal.
- Exercises: reverse a linked list, detect and remove loops.

5. **Trees:-**

- Implementing binary trees and binary search trees (BST).
- Tree traversals: preorder, inorder, postorder.
- Exercises: searching in a BST, finding the lowest common ancestor.

6. **Graphs:-**

- Representing graphs using adjacency matrix and adjacency list.
- Graph traversals: BFS and DFS.
- Exercises: shortest path algorithms (Dijkstra's or Floyd-Warshall), spanning tree algorithms (Prim's or Kruskal's).

7. **Sorting Algorithms:-**

- Implementing and comparing sorting algorithms: bubble sort, insertion sort, selection sort, quicksort, mergesort.
- Exercises: analyze time complexity, sort different types of data (numbers, strings).

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Name of Paper	Paper Code	Practical				
		Credit		**Marks**		
Programming Lab in C++	**MAI-107**	**P**	**J**	**ESP**	**CAP**	**Total**
		2	-	30	20	50

Content:

1. Simple C++ programs to implement various control structures.
   - if statement
   - switch case statement and do while loop
   - for loop
   - while loop
   - Array
2. Write a program Illustrating Class Declarations, Definition, and Accessing Class Members
3. Write a C++ Program to illustrate default constructor, parameterized constructor and copy constructors
4. WAP to find the largest of three numbers using inline function.
5. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.
6. Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).
7. Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.
8. WAP to Illustrate Multilevel Inheritance.
9. WAP to Demonstrate Multiple Inheritances.
10. Write a Program to demonstrate friend function and friend class.
11. Write a C++ to illustrate the concepts of console I/O operations.
12. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.
13. Write a Program to illustrate New and Delete Keywords for dynamic memory allocation
14. Write a C++ program to allocate memory using new operator.
15. WAP to demonstrate template class
16. WAP to demonstrate template function.

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Name of Paper	Paper Code	Theory					
		Credit			Marks		
		L	T	J	EST	CAT	Total
Disaster Management	FC-111	-	-	-			

Course Objective	The Programme has been framed with an intention to provide a general concept in the dimensions of disasters caused by nature beyond human control as well as the disasters and environmental hazards induced by human activities with emphasis on Natural disaster, Man-made disaster.

Units	Contents (*Theory*)	Hours /week
I	**Introduction:** Hazard, Risk, Vulnerability, Disaster; Disaster Management, Meaning, Nature Importance, Dimensions & Scope of Disaster Management, Disaster Management Cycle. National disaster management framework; financial arrangements for Disaster management, International Strategy for Disaster reduction	2
II	**Natural Disasters:** Meaning and nature of natural disasters, their types and effects, Hydrological Disasters - Flood, Flash flood, Drought, cloud burst, Geological Disasters- Earthquakes, Landslides, Avalanches, Volcanic eruptions, Mudflow Unit, Wind related- Cyclone, Storm, Storm surge, tidal waves, Heat and cold Waves, Climatic Change, Global warming, Sea Level rise, Ozone Depletion	2
III	**Man made Disaster:** CBRN – Chemical disasters, biological disasters, radiological disasters, nuclear disasters Fire – building fire, coal fire, forest fire, Oil fire	2
IV	**Types of Man – made Disasters:** Accidents- road accidents, rail accidents, air accidents, sea accidents Pollution and deforestation- air pollution, water pollution, deforestation, Industrial wastewater pollution, deforestation	2
V	**Disaster Determinants:** Factors affecting damage – types, scale population, social status, habitation pattern, physiology and climate. Factors affecting mitigation measures, prediction, preparation, communication, area and accessibility, population, physiology and climate	2

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Text Books/Reference Books:-			
Name of Authors	**Titles of the Book**	**Edition**	**Name of the Publisher**
S. L. Goel	Disaster Administration and Management, Text & Case studies-		Deep and Deep Publications
G.K. Ghosh	Disaster Management		A.P.H. Publishing Corporation
Vinod K Sharma-	Disaster Management		IIPA
S. K. Singh, S.C. Kundu, Shobha Singh	Disaster Management		William Publications

COURSE OUTCOMES: Students will be able to	
CO1	Know disaster management processes and financial arrangements.
CO2	Know various natural disasters and its effects.
CO3	Know various Man Made disasters and its effects.
CO4	Know consequences of air pollution and deforestation.
CO5	Know disaster determinants and mitigation measures.