UNIVERSITY OF MADRAS

MASTER OF COMPUTER APPLICATIONS (MCA) DEGREE PROGRAMME

SYLLABUS WITH EFFECT FROM 2023-2024

Title of the Paper	**Data Structures and Algorithms**		
Core - II Theory	I Year & I Semester	Credit:4	435C1B

Course Objectives:

To get a clear understanding of various ADT structures.

To understand how to implement different ADT structures with real-time scenarios.

To analyze the various data structures with their different implementations.

To get an idea of applying right models based on the problem domain.

To realize, and understand how and where to implement modern data structures with Python language.

Unit I: Abstract Data Types: Introduction-Date Abstract Data Type-Bags-Iterators. Arrays: Array Structure-Python List-Two Dimensional Arrays-Matrix Abstract Data Type. Sets, Maps: Sets-Maps- Multi-Dimensional Arrays.

Unit II: Algorithm Analysis: Experimental Studies-Seven Functions-Asymptotic Analysis. Recursion: Illustrative Examples-Analyzing Recursive Algorithms-Linear Recursion- Binary Recursion-Multiple Recursion.

Unit III: Stacks, Queues, and Deques: Stacks- Queues- Double-Ended Queues Linked. Lists: Singly Linked Lists-Circularly Linked Lists-Doubly Linked Lists. Trees: General Trees-Binary Trees-Implementing Trees-Tree Traversal Algorithms.

Unit IV: Priority Queues: Priority Queue Abstract Data Type- Implementing a Priority Queue-Heaps-Sorting with a Priority Queue. Maps, Hash Tables, and Skip Lists: Maps and Dictionaries-Hash Tables- Sorted Maps-Skip Lists-Sets, Multisets, and Multimaps.

Unit V: Search Trees: Binary Search Trees-Balanced Search Trees-AVL Trees-Splay Trees. Sorting and Selection: Merge sort-Quick sort-Sorting through an Algorithmic Lens- Comparing Sorting Algorithms-Selection. Graph Algorithms: Graphs-Data Structures for Graphs-Graph Traversals-Shortest Paths-Minimum Spanning Trees.

Text book:

1. Rance D. Necaise, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011. (Unit – 1)Chapters: 1, 2, 3.
2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, John Wiley & Sons, 2013. (Unit – 2, 3, 4, and 5)Chapters: 3 to 12, and 14.

Reference books:

1. Dr. Basant Agarwal; Benjamin Baka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7", Packt Publishing, 2018.
2. Magnus Lie Hetland, "Python Algorithms: Mastering Basic Algorithms in the Python Language", Apress, 2014.

Course Outcome:

On the successful completion of the course, students will be able to

CO1	Understand various ADT concepts	K2	LO
CO2	Familiar with implementation of ADT models with Python language and understand how to develop ADT for the various real-time problems	K4,K5	HO
CO3	Apply with proper ADT models with problem understanding	K5	HO
CO4	Apply and Analyze right models based on the problem domain	K1	LO
CO5	Evaluate modern data structures with Python language	K5	HO

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	L	L	L	L	S	S	M	M
CO2	S	M	S	M	M	L	S	M	S	L
CO3	S	S	S	L	L	L	M	M	M	M
CO4	S	S	S	M	M	S	M	M	S	S
CO5	S	S	S	S	L	M	S	M	M	M

L - Low, M- Medium, S - Strong