



MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956

COURSE CONTENT

ADVANCED DATA STRUCTURES								
I Semester: CSE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2515802	Foundation	3	0	0	3	40	60	100
		Contact Classes: 45			Tutorial Classes: Nil		Practical Classes: Nil	
Prerequisites: A course on "Data Structures"								

Course Overview:

Advanced Data Structures focuses on the design, analysis, and implementation of efficient data organization techniques for complex computational problems. The course covers trees, graphs, hashing, heaps, advanced searching and sorting methods, and balanced structures such as AVL and Red-Black trees. It emphasizes algorithmic efficiency using time and space complexity analysis with applications in real-world system

Course Objectives:

1. To understand the concepts and implementation of advanced data structures used for efficient data storage and retrieval.
2. To learn heap-based data structures such as Leftist Trees, Binomial Heaps, Fibonacci Heaps, and Min-Max Heaps.
3. To study hashing techniques, collision resolution methods, and their applications in efficient searching.
4. To analyze and implement advanced search structures including AVL Trees, Red-Black Trees, Splay Trees, B-Trees, and Tries.
5. To develop problem-solving skills by applying advanced data structures and pattern matching algorithms for efficient algorithm design and analysis.

Course Outcomes: After Completion of the Course, Students should be able to

1. Apply heap and hashing techniques for efficient data organization and retrieval in real-world applications of databases and memory management.
2. Analyze balanced and multiway search trees for dynamic searching operations in multidisciplinary domains of network routing and AI-based search systems.
3. Implement digital search structures such as tries and suffix trees for software engineering and compiler design.
4. Evaluate collision resolution strategies and hashing methods for research in cryptography and distributed systems.
5. Design efficient pattern-matching solutions using classical and advanced algorithms for industry applications in cybersecurity and text analytics.

UNIT - I:

Heap Structures

Introduction, Min-Max Heaps, Leftist trees, Binomial Heaps, Fibonacci heaps.

UNIT - II:

Hashing and Collisions

Introduction, Hash Tables, Hash Functions, different Hash Functions: - Division Method, Multiplication Method, Mid-Square Method, Folding Method, Collisions

UNIT - III:

Search Structures: OBST, AVL trees, Red-Black trees, Splay trees, Multiway Search Trees, B-trees, 2-3 trees.

UNIT - IV:

Digital Search Structures, Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees, Standard Tries, Compressed Tries

UNIT - V:

Pattern matching, Introduction, Brute force, the Boyer –Moore algorithm, Knuth-Morris-Pratt algorithm, Naïve String, Harspool, Rabin Karp

TEXT BOOKS:

1. Fundamentals of data structures in C++ Sahni, Horowitz, Mehatha, Universities Press.
2. Introduction to Algorithms, TH Cormen, PHI

REFERENCE BOOKS:

1. Design methods and analysis of Algorithms, SK Basu, PHI.
2. Data Structures & Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education.
3. Fundamentals of Computer Algorithms, 2nd Edition, Ellis Horowitz, Sartaj Sahni, Sangu Thevar Rajasekaran, Universities Press.

ELECTRONIC RESOURCES:

1. <https://www.geeksforgeeks.org/advanced-data-structures/>
2. <https://www.studytonight.com/advanced-data-structures/>
3. <https://www.tutorialspoint.com/course/advanced-data-structures/index.asp>
4. <https://www.coursera.org/learn/advanced-data-structures/>

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)