COURSE CONTENT

ADVANCED DATA STRUCTURES								
I Semester: CSE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
2415802	**Foundation**	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
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. Demonstrate the use of advanced heap structures to address priority-based and optimization problems.
2. Analyze hashing functions in conjunction with collision resolution strategies to improve the performance of data retrieval systems.
3. Construct balanced search structures to enhance performance in large datasets.
4. Conduct an assessment of digital search structures to ensure efficient storage and retrieval of string and sequence data within a designated database
5. Distinguish various pattern matching algorithms applied in text processing and analysis.

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, MultiplicationMethod, 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, CompressedTries

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)