



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Artificial Intelligence and Data Science

Subject Code : ME02095011

Course/Subject Name: Advanced Data Structures & Algorithms

WEF Academic Year	2024-25
Semester	2
Category of the Course	PCC

Prerequisite	Basic understanding of linear and nonlinear data structures.
Rationale:	<ul style="list-style-type: none">The course provide an insight of advance concepts related to data structures and applications.The course focus on to gain the knowledge about the fundamental use of advance data structures.

Course Outcome:

After completion of the Course, Students will be able to:

No	Course Outcomes	RBT Level*
01	Understand the fundamental design concepts of data structures.	UN
02	Apply the tree data structure for search operation optimality.	AP
03	Apply the heap and hash tables as advance application of data structures.	AP
04	Analyse advance data structures for strings with its applications.	AN
05	Evaluate various distrusted data structures for better understanding.	EL

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Teaching and Examination Scheme:

Teaching Scheme (in hours)			Total Credits (L+T+PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				ESE (E)	PA/CA (M)	PA/CA (I)	ESE (V)	
03	00	02	04	70	30	20	30	150



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Course Content:

Unit	Course Content	No of Hours	% of Weightage
1.	Introduction: Design of data structure, Analysis of data structure, Amortized complexity, Computational models, Bounds of fundamental data structures.	4	10
2.	Balanced Search Trees: Balanced Binary Search Trees(BSTs), Height-Balanced Trees, Weight-Balanced Trees, Randomized BSTs. Splay Tree, Tango Tree, Skip lists, Search optimality in BST, Static optimality, Dynamic optimality	8	20
3.	Heaps: Balanced Search Trees as Heaps, Array-based Heaps, Heap-Ordered Trees and Half-Ordered Trees, Leftist Heaps, Skew Heaps, Binomial Heaps, Changing Keys in Heaps, Fibonacci Heaps, Heaps of Optimal Complexity, Double-Ended Heap Structures and Multidimensional Heaps.	9	20
4.	Hash Tables: Basic Hash Tables and Collision Resolution, Universal Families of Hash Functions, Perfect Hash Functions, Hash Trees, Extendible Hashing, Cuckoo Hashing	8	20
5.	Data Structures for Strings: Tries and Compressed Tries, Dictionaries Allowing Errors in Queries, Suffix Trees, Suffix Arrays.	8	20
6.	Distributed Data Structures: Descriptions of Structures, Distributed Hashing, Distributed Trees, Skip Graphs, Making Structures Dynamic, Making Structures Persistent,	8	10
TOTAL		45	100



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Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	20	20	20	10

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Reference/Suggested Learning Resources:

(a) Books:

1. Advanced Data Structures, Peter Brass, Cambridge University Press.
2. Advanced Data Structures, Suman Saha, Shailendra Shukla, CRC Press, Taylor & Francis Group.
3. Advanced Algorithms and Data Structures, Marcello La Rocca, Manning Publications Co.

(b) Open source software and website

- Course-related online MOOCs on NPTEL/SWAYAM platform.
- Recently Published papers/articles in reputed journals.

Suggested Course Practical List:

- The practical work will be carried out based on the content covered during the academic sessions.

List of Laboratory/Learning Resources Required: Programming development environment (open source is encouraged) related to the course content.

Suggested Project List: The subject teacher has to assign the relevant project work to the students in individual/team.



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Suggested Activities for Students: The subject teacher has to assign the outcome based activities to the students in individual/team.
