UkaTarsadia University

C. G. Patel Institute of Technology

B. Tech.

Semester – 6

(030090611)

ADVANCED DATA STRUCTURES

EFFECTIVE FROM July-2017

Syllabus version: 1.01

UkaTarsadia University

Version 1.01

SEMESTER – 6

Advanced Data Structures
(030090611)

Credits: 4 (Theory) **Contact hours per week: 4 (Theory)**

Objective:

The objective of this course is to provide students the clarity of fundamentals of data structures

- To provide clarity of fundamentals of data structures with an understanding of advanced topics to solve problems.
- To examine appropriate data structure for specific problem solving.

Outcome:

Upon completion of the course, the student shall be able to

CO1	Understand the usage of abstract data type stack, queue and link list.
CO2	Develop and understand algorithms for AVL tree, Splay and Red Black Tree.
CO3	Understand storing and retrieving of data using hash table.
CO4	Understand the usage of priority queue.
CO5	Understand and identify suitable sorting and searching techniques for specific problems.
CO6	Understand algorithm for network problems.

B. Tech.	Subject	Hours
Sem 6	(030090611) Advanced Data Structures	4 hrs/week
	(Theory)	4 Credits
Sr.No.	Topic	Hours
	Unit – I	
1	**Elementary data structures:** Abstract Data Type (ADT), The list ADT, vector and list in STL, Implementation of vector and list, The stack ADT, The queue ADT	8
	Unit – II	
2	**Trees:** Binary search tree, Height balance tree, AVL tree, Splay tree,Tree traversal,B-Tree of order m, Heap tree, Binomial heap,Red-Black tree.	14
	Unit – III	
3	**Hashing and Skip lists:** Hash table representation, Hash functions, Collision resolution - Separate chaining, Open addressing- Linear probing, Quadratic probing, Double hashing, Rehashing,Dictionaries, Linear list representation, Skip list representation, Operations - Insertion, Deletion and Searching, Comparison of hashing and skip lists.	8
	Unit – IV	
4	**Priority queue:** Binary heap, Application of priority queue, d-Heaps, Leftist Heaps, Skew heap, Binomial queues, Priority Queue in standard library.	8
	Unit – V	
5	**Sorting and searching techniques:** Bubble sort, Selection sort, Insertion sort, Shell sort, Heap sort, Merge sort, Quick sort, Indirect Sorting, Bucket sort, Sequential search, Binary search.	8
	Unit – VI	
6	**Graph:** Topological sort, Shortest-path algorithms, Network flow problems, Minimum spanning tree, Application of Depth-First-Search	14

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Practical

(030090611)

Advanced Data Structures

Credit: 1 (Practical) **Contact hours per week: 2 (Practical)**

Sr. No.	Advanced Data Structures (Practical)	Hours
1	Write a menu driven program, with the help of functions to insert student information and display student information(s) for the followings. - Define a structure of student information that holds a string of20 characters called name, a string of 50 characters calledaddress, three integers called year of birth, month of birth andday of birth and admission number. - Prepare the array called 2nd Year Class using the above - Studentstructure for 10 students. - Define a structure of subject marks in the student structurewhich holds internal test marks, mid semester marks and endsemester marks.	2
2	Write a program that will reverse the string using stack.	2
3	Write a program to implement Queueoperations as Create(), IsEmpty(), Insert(), Delete(), IsFull() with appropriate prototype to a functions.	2
4	Write a menu driven program to implement following operations on the singly linked list. - Insert a node at the front of the linked list. - Insert a node at the end of the linked list. - Delete the node from specific position.	4
5	Write a program to generate the binary tree from the given inorder and postorder traversal.	4
6	Write a program to implement insertion, deletion and display operation in Max Heap for the data as integers	4
7	Write a program to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n. To handle the collisions use the following collision resolution techniques - Linear Probing - Chaining	4
8	Write a program to implement Quick Sort on 1D array of Student structure contains student_name, student_roll_no, total_marks, with key as student_roll_no.	4
9	Write a program to implement Binary search on 1D array of Employee structure contains employee_name, emp_no, emp_salary, with key as emp_no.	4

Text book:

1. Mark AllenWeiss- “Data Structures and algorithm analysis in C++", 3rd Edition, Pearson Education.

Reference books:

1. Jean-Paul Tremblay & Paul G. Sorenson– “An Introduction to Data Structures with Applications”, Tata McGraw Hill.
2. SartajSahani - “Data Structures, Algorithms and application using C++” - Universities Press.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein – “Introduction to Algorithms”, PHI.

Course objectives and Course outcomes mapping:

- To provide clarity of fundamentals of data structures with an understanding of advanced topics to solve problems: CO1, CO2, CO3, CO4, CO5, CO6.
- To examine appropriate data structure for specific problem solving:CO1, CO2, CO5, CO6.

Course units and Course outcome mapping:

	CO1	CO2	CO3	CO4	CO5	CO6
Elementary data structures	√					
Trees		√				
Hashing and Skip lists			√			
Priority queue				√		
Sorting and searching techniques					√	
Graph						√

Programme Outcomes:

- **PO 1: Engineering knowledge:** An ability to apply knowledge of mathematics, science, and engineering
- **PO 2: Problem analysis:** An ability to identify, formulates, and solves engineering problems
- **PO 3: Design/development of solutions:** An ability to design a system, component, or process to meet desired needs within realistic constraints
- **PO 4: Conduct investigations of complex problems:** An ability to use the techniques, skills, and modern engineering tools necessary for solving engineering problems.
- **PO 5: Modern tool usage:** The broad education and understanding of new engineering techniques necessary to solve engineering problems.
- **PO 6: The engineer and society:** Achieve professional success with an understanding and appreciation of ethical behavior, social responsibility, and diversity, both as individuals and in team environments.

- **PO 7: Environment and sustainability:** Articulate a comprehensive world view that integrates diverse approaches to sustainability.
- **PO 8: Ethics:** Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.
- **PO 9: Individual and team work:** An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO 10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give/receive clear instructions.
- **PO 11: Project management and finance:** An ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO 12: Life-long learning:** A recognition of the need for, and an ability to engage in life-long learning.

Programme Outcomes and Course Outcomes mapping:

Program Outcomes	Course Outcomes					
	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
PO 1	√	√	√	√	√	√
PO 2	√	√	√	√	√	√
PO 3	√			√	√	√
PO 4		√				√
PO 5		√				√
PO 6						
PO 7						
PO 8						
PO 9						
PO 10						
PO 11						
PO 12	√	√	√	√	√	√