K L Deemed to be University
Department of Computer Science and Engineering -- KLHYD
Course Handout
2021-2022, Even Sem

Course Title	:DATA STRUCTURES
Course Code	:21SC1202
L-T-P-S Structure	: 3-0-2-4
Pre-requisite	:
Credits	: 5
Course Coordinator	:LINGAM SUNITHA
Team of Instructors	:
Teaching Associates	:

Syllabus :
Algorithm Analysis: Mathematical Background, Model, Analyze, Running Time Calculations. Sorting: Introduction to Sorting Algorithm, Insertion Sort, Shell sort, Heap sort, Merge sort, Quick sort, Bucket Sort, External Sorting. Dynamic Memory implementation of linear datastructures: Singly Linked list, doubly linked list, circularly linked list, Applications of data structures: Polynomial Manipulation, Implementation of Stacks and Queues using Linked Lists, Circular Queue, Deque(Double ended queue), Applications of Stacks and Queues. Priority Queues (Heaps): Model, Simple Implementations, Binary Heap, Applications of Priority Queues. Hashing: Introduction to Hashing, Hash Function, Separate Chaining, Hash Tables without Linked Lists, Rehashing, Hash Tables in the Standard Library, Extendible Hashing. Trees: Introduction to trees, Binary Trees, Tree Traversals, The Search Tree: Binary Search Trees, AVL Trees, Splay Trees, B-Trees, Red black trees. Graph Data Structure: Introduction to Graph data structure – basic terminologies- transitive closure -representation of graphs: adjacency matrix, linked list- Graph traversals: Breadth First Search, Depth First Search)- minimal spanning trees: Prim's &Kruskal's Algorithm

Text Books :
1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2010 , Second Edition, PearsonEducation.
2. Ellis Horowitz, Fundamentals of Data Structures in C: Second Edition, 2015

Reference Books :
1. A.V.Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures And Algorithms", Pearson Education, First Edition Reprint2003.
2. Horowitz, Sahni, Anderson Freed, "Fundamentals of datastructures in C" , Second Edition-2007.
3. R. F. Gilberg, B. A. Forouzan, "Data Structures", Second Edition, Thomson India Ed ition, 2005
4. Robert Kruse, C.L. Tondo, Bruce Leung, Shashi Mogalla, "Data Structures & Program Design in C", FourthEdition-2007.

MOOCS :
1. https://nptel.ac.in/courses/106102064
2. https://nptel.ac.in/courses/106101060/4
3. https://www.edx.org/course/algorithms-and-data-structures-1
4. https://in.udacity.com/course/intro-to-algorithms--cs215
5. https://www.coursera.org/learn/data-structures?action=enroll

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand various sorting algorithms and analyze the efficiency of the algorithms	PO1,PO2	4
CO2	Implement and evaluate Linear Data Structures and Demonstrate their applications.	PO2,PO3,PO1	4
CO3	Implement and evaluate tree data structures and Understand hashing techniques	PO1,PO2,PO3	4
CO4	Understand graph data structures and apply graphs to solve problems	PO1,PO2	3
CO5	Design, Develop and evaluate common practical applications for linear and nonlinear data structures.	PO9,PO10,PO3	5

COURSE OUTCOME INDICATORS (COIs)::

Outcome No.	Highest BTL	COI-1	COI-2	COI-3	COI-4	COI-5
CO1	4	**Btl-1** Mathematical background, model	**Btl-2** Introduction to sorting. Demonstrate and Implement	**Btl-3** Introduction to Divide and Conquer Approach.	**Btl-4** Demonstrate External sorting and Bucket	

		and running time calculations.	Insertion Sort, Shell Sort, and Heap Sort	Demonstrate and Implement Merge Sort and Quick Sort.	Sorting. Analyze its Efficiency	
CO2	4	**Btl-4** Introduction to Dynamic Memory Allocation and List-based implementation. Illustrate implementation of different Lists and its applications	**Btl-2** List based implementations of Stack and Enumerate its applications.	**Btl-3** List based implementations of Queue and Enumerate its applications.	**Btl-4** Model of priority queues and Implementation of Binary Heap and Demonstrate applications	
CO3	4	**Btl-1** Introduction to Hashing table, Hashing function, Separate chaining and open addressing	**Btl-2** Double hashing, Extendible hashing and Rehashing	**Btl-3** Tree traversal and Search trees construction and implementation	**Btl-4** Demonstrate Red-Black tree, Splay tree and B- tree	
CO4	3	**Btl-1** Introduction to Graph data structure – Basic terminologies. Transitive closure and representation of graphs	**Btl-2** Graph Traversing techniques – Demonstrate Breadth First Search and Depth First Search		**Btl-3** Minimum spanning tree – Prim's algorithm	
CO5	5	**Btl-1** Recall the linear and nonlinear data structures.	**Btl-3** Exemplify the linear and nonlinear data structures with real time applications.	**Btl-3** Use the linear and nonlinear data structures with real time applications	**Btl-4** Appraise and Differentiate the linear and nonlinear data structures based on their properties	**Btl-5** Discriminate the significance of both linear and nonlinear data structures with respect to real world applications.

PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES (POs/PSOs)

Po No.	Program Outcome
PO1	Engineering Knowledge:Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences
PO3	Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO4	Conduct Investigations of Complex Problems:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline.
PO5	Modern Tool Usage:Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	The Engineer and Society:Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and Sustainability:Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO9	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	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 and receive clear instructions
PO11	Project Management and Finance: 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.
PO12	Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong

	learning in the broadest context of technological change.
PSO1	An ability to design and develop software projects as well as Analyze and test user requirements.
PSO2	An Ability to gain working Knowledge on emerging software tools and technologies.

Lecture Course DELIVERY Plan:

Sess.No.	CO	COI	Topic	Book No[CH No][Page No]	Teaching-Learning Methods	EvaluationComponents
1	CO1	COI-1	Introduction to data structures-Mathematical background, Model	Ref Book [1], CH 3.1 Page no 57-58	Chalk,PPT,Talk	ALM,End Semester Exam,HA,SEM-EXAM1
2	CO1	COI-1	Algorithm Analysis - Running time calculations	Ref Book [1], CH 2.1 Page no 31-36	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,HA,SEM-EXAM1
3	CO1	COI-2	Insertion Sort Analysis and Implementation	Ref Book [1], CH 7.2 Page no 235 -237	Chalk,PPT,Talk	ALM,End Semester Exam,HA,SEM-EXAM1
4	CO1	COI-1	Shell Sort Analysis and Implementation	Ref Book [1], CH 7.4 Page no 238-240	Chalk,PPT,Talk	ALM,Home Assignment,SEM-EXAM1
5	CO1	COI-2	Quick Sort	Ref Book [1], CH 7.7 Page no 252-262	Chalk,PPT,Talk	ALM,Home Assignment,SEM-EXAM1
6	CO1	COI-2	Quick Sort Implementation	nil	PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
7	CO1	COI-2	Merge Sort Analysis and Implementation	nil	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
8	CO1	COI-1	Demonstrate Bucket Sort	nil	Chalk,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
9	CO1	COI-1	Demonstrate External Sorting	nil	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
10	CO2	COI-1	Demonstrate External Sorting	Ref Book [1], CH 3.1 Page no 57-58	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
11	CO2	COI-2	Doubly Linked list -Creation, Insertion, Deletion, Display	Ref Book [1], CH 3.2 Page no 59-68	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
12	CO2	COI-2	Circular Linked list - Creation, Insertion, Deletion, Display	Ref Book [1], CH 3.2 Page no 59-68	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
13	CO2	COI-2	Stack Using Singly Linked list	Ref Book [1], CH 3.3 Page no 78-101	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
14	CO2	COI-3	Queue Using Singly Linked List	Ref Book [1],CH 3.3Page no 78-101	Chalk,LTC,PPT,Talk	End Semester Exam,Home Assignment,SEM-EXAM1

Sess.No.	CO	COI	Topic	Book No[CH No][Page No]	Teaching-Learning Methods	EvaluationComponents
15	CO2	COI-2	Infix to Postfix Expression Conversion	Ref Book [1], CH 3.3 Page no 78-93	Chalk,LTC,PPT,Talk	ALM,Home Assignment,SEM-EXAM1
16	CO2	COI-3	Infix to Postfix Expression Conversion Implementation	Ref Book [1], CH 3.3 Page no 78-93	Chalk,LTC,PPT	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
17	CO2	COI-2	Evaluation of postfix expression, Balancing symbols	CH 3.3 Page no 88- 90	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
18	CO2	COI-2	Types of Queue – Circular Queue	Ref Book [1], CH 3.4 Page no 95-101	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
19	CO2	COI-3	Types of Queue – Deque	nil	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
20	CO2	COI-2	Binary Heap	T. Book [1], CH 3.4 Page no 95-108	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
21	CO3	COI-1	Hashing - Hash function, Separate chaining	Ref Book [1], CH 5.3 Page no 168 -172	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
22	CO3	COI-2	Linear probing and Quadratic probing	nil	LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
23	CO3	COI-2	Double hashing	Ref Book [1], CH 5.4 Page no 180-181	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
24	CO3	COI-3	Rehashing and Extendible hashing	Ref Book [1], CH 5.4 Page no 168-180	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
25	CO3	COI-3	Binary Tree - Tree traversals, Expression tree construction	Ref Book [1], CH 4.2 Page no 108 - 116	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
26	CO3	COI-3	Binary Search Tree – Construction, Insertion, Deletion	Ref Book [1], CH 4.3 Page no 116-123	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
27	CO3	COI-3	Binary Search Tree Implementation	Ref Book [1], CH 4.3 Page no 116-123	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
28	CO3	COI-3	AVL Tree – Rotations and Operations	Ref Book [1], CH 4.4 Page no 127-138	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
29	CO3	COI-3	AVL Tree Implementation	Ref Book [1], CH 4.4 Page no 127-138	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
30	CO3	COI-3	Heap Sort Analysis and Implementation	Ref Book [1], CH 7.5 Page no 242-2	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2

Sess.No.	CO	COI	Topic	Book No[CH No][Page No]	Teaching-Learning Methods	EvaluationComponents
31	CO3	COI-3	B – Tree Construction	T. Book [1], CH 4.7 Page no 134-138	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,SEM-EXAM2
32	CO3	COI-3	Splay tree operations	RefBook [1], CH 4.5,Page no 138 - 141	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,SEM-EXAM2
33	CO3	COI-3	Construction of Red-Black trees	RefBook [1], CH 4.6, Page no 134-140	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
34	CO3	COI-2	Graphs Representation – Adjacency Matrix	Ref Book [1],CH 9.1Page no 300-302	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
35	CO4	COI-2	Graphs Representation – Linked List	Ref Book [1], CH 9.1 Page no 300-302	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
36	CO4	COI-2	Transitive Closure	Ref Book [1], CH 9.1 Page no 299-300	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
37	CO4	COI-2	Graph Traversal – BFS, DFS	Ref Book [1], CH 9.2 Page no 302 - 306	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
38	CO4	COI-4	Minimum Spanning Tree – Prim's Algorithm	Ref Book [1], CH 9.5 Page no 330-332	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2
39	CO4	COI-4	Minimum Spanning Tree - Kruskal's Algorithm	Ref Book [1], CH 9.5 Page no 332 – 335	Chalk,LTC,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2

Lecture Session wise Teaching – Learning Plan

SESSION NUMBER : 1

Session Outcome: 1 Introduction to data structures- Mathematical background, Model

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Introduction to data structures- Mathematical background, Model	1	Talk	Quiz/Test Questions

SESSION NUMBER : 2

Session Outcome: 2 Algorithm Analysis - Running time calculations

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Algorithm Analysis - Running time calculations	2	Chalk	Quiz/Test Questions

SESSION NUMBER : 3

Session Outcome: 2 Insertion Sort Analysis and Implementation

Time(min)	Topic	BTL	Teaching-Learning	Active Learning Methods

			Methods	
50	Insertion Sort Analysis and Implementation	2	PPT	Quiz/Test Questions

SESSION NUMBER : 4

Session Outcome: 2 Shell Sort Analysis and Implementation

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Shell Sort Analysis and Implementation	2	PPT	Quiz/Test Questions

SESSION NUMBER : 5

Session Outcome: 2 Quick Sort

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Quick Sort	2	Talk	Quiz/Test Questions

SESSION NUMBER : 6

Session Outcome: 2 Quick Sort Implementation

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Quick Sort Implementation	2	Talk	Quiz/Test Questions

SESSION NUMBER : 7

Session Outcome: 2 Merge Sort Analysis and Implementation

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Merge Sort Analysis and Implementation	2	LTC	Quiz/Test Questions

SESSION NUMBER : 8

Session Outcome: 2 Demonstrate Bucket Sort

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Demonstrate Bucket Sort	2	LTC	Quiz/Test Questions

SESSION NUMBER : 9

Session Outcome: 3 Demonstrate External Sorting

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Demonstrate External Sorting	3	Talk	Quiz/Test Questions

SESSION NUMBER : 10

Session Outcome: 1 Demonstrate External Sorting

Time(min)	Topic	BTL	Teaching-	Active Learning

			Learning Methods	Methods
50	Demonstrate External Sorting	2	PPT	Seminars

SESSION NUMBER : 11

Session Outcome: 2 Doubly Linked list -Creation, Insertion, Deletion, Display

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Doubly Linked list -Creation, Insertion, Deletion, Display	2	PPT	Quiz/Test Questions

SESSION NUMBER : 12

Session Outcome: 2 Circular Linked list - Creation, Insertion, Deletion, Display

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Circular Linked list - Creation, Insertion, Deletion, Display	2	LTC	Quiz/Test Questions

SESSION NUMBER : 13

Session Outcome: 3 Stack Using Singly Linked list

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Stack Using Singly Linked list	3	LTC	Quiz/Test Questions

SESSION NUMBER : 14

Session Outcome: 3 Stack Using Singly Linked list

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Stack Using Singly Linked list	2	LTC	Quiz/Test Questions

SESSION NUMBER : 15

Session Outcome: 3 Infix to Postfix Expression Conversion

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Infix to Postfix Expression Conversion	2	LTC	Quiz/Test Questions

SESSION NUMBER : 16

Session Outcome: 3 Infix to Postfix Expression Conversion Implementation

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Infix to Postfix Expression Conversion Implementation	3	LTC	Quiz/Test Questions

SESSION NUMBER : 17

Session Outcome: 3 Evaluation of postfix expression, Balancing symbols

Time(min)	Topic	BTL	Teaching-	Active Learning

			Learning Methods	Methods
50	Evaluation of postfix expression, Balancing symbols	3	PPT	Quiz/Test Questions

SESSION NUMBER : 18

Session Outcome: 3 Types of Queue – Circular Queue

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Types of Queue – Circular Queue	3	LTC	Group Discussion

SESSION NUMBER : 19

Session Outcome: 3 Types of Queue – Deque

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Types of Queue – Deque	3	LTC	Seminars

SESSION NUMBER : 20

Session Outcome: 3 Binary Heap

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Binary Heap	2	LTC	Quiz/Test Questions

SESSION NUMBER : 21

Session Outcome: 2 Hashing - Hash function, Separate chaining

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Hashing - Hash function, Separate chaining	2	LTC	Quiz/Test Questions

SESSION NUMBER : 22

Session Outcome: 2 Linear probing and Quadratic probing

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Linear probing and Quadratic probing	3	LTC	Group Discussion

SESSION NUMBER : 23

Session Outcome: 2 Double hashing

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Double hashing	3	LTC	Quiz/Test Questions

SESSION NUMBER : 24

Session Outcome: 3 Rehashing and Extendible hashing

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods

50	Rehashing and Extendible hashing	3	LTC	Seminars

SESSION NUMBER : 25

Session Outcome: 3 Binary Tree - Tree traversals, Expression tree construction

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Binary Tree - Tree traversals, Expression tree construction	3	LTC	Quiz/Test Questions

SESSION NUMBER : 26

Session Outcome: 3 Binary Search Tree – Construction, Insertion, Deletion

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Binary Search Tree – Construction, Insertion, Deletion	2	LTC	Quiz/Test Questions

SESSION NUMBER : 27

Session Outcome: 3 Binary Search Tree Implementation

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Binary Search Tree Implementation	3	LTC	Seminars

SESSION NUMBER : 28

Session Outcome: 3 AVL Tree – Rotations and Operations

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	AVL Tree – Rotations and Operations	3	LTC	Seminars

SESSION NUMBER : 29

Session Outcome: 3 AVL Tree Implementation

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	AVL Tree Implementation	3	LTC	Group Discussion

SESSION NUMBER : 30

Session Outcome: 4 Heap Sort Analysis and Implementation

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Heap Sort Analysis and Implementation	2	LTC	Quiz/Test Questions

SESSION NUMBER : 31

Session Outcome: 3 B – Tree Construction

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	B – Tree Construction	3	LTC	Quiz/Test Questions

SESSION NUMBER : 32

Session Outcome: 3 Splay tree operations

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Splay tree operations	3	PPT	Seminars

SESSION NUMBER : 33

Session Outcome: 3 Construction of Red-Black trees

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Construction of Red-Black trees	3	LTC	Quiz/Test Questions

SESSION NUMBER : 34

Session Outcome: 2 Graphs Representation – Adjacency Matrix

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Graphs Representation – Adjacency Matrix	3	LTC	Seminars

SESSION NUMBER : 35

Session Outcome: 2 Graphs Representation – Linked List

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Graphs Representation – Linked List	2	LTC	Quiz/Test Questions

SESSION NUMBER : 36

Session Outcome: 3 Transitive Closure

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Transitive Closure	2	LTC	Group Discussion

SESSION NUMBER : 37

Session Outcome: 2 Graph Traversal – BFS, DFS

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Graph Traversal – BFS, DFS	3	LTC	Quiz/Test Questions

SESSION NUMBER : 38

Session Outcome: 4 Minimum Spanning Tree – Prim’s Algorithm

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Minimum Spanning Tree – Prim’s Algorithm	3	LTC	Quiz/Test Questions

SESSION NUMBER : 39

Session Outcome: 4 Minimum Spanning Tree - Kruskal's Algorithm

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
50	Minimum Spanning Tree - Kruskal's Algorithm	4	LTC	Quiz/Test Questions

Tutorial Course DELIVERY Plan: NO Delivery Plan Exists

Tutorial Session wise Teaching – Learning Plan

No Session Plans Exists

Practical Course DELIVERY Plan:

Tutorial Session no	Topics	CO-Mapping
1	nsertion Sort and Shell Sort	CO5
2	Quick sort	CO5
3	merge sort technique	CO5
4	singly linked list operations	CO5
5	doubly linked list and circular linked list	CO5
6	implement stack using singly linked list	CO5
7	queue using singly linked list	CO5
8	stack applications	CO5
9	different hashing techniques	CO5
10	binary search tree operations	CO5
11	AVL tree operations	CO5
12	graph traversing techniques	CO5

Practical Session wise Teaching – Learning Plan

SESSION NUMBER : 1

Session Outcome: 1 Students able to implement insertion sort and shell sort

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
40	Implement Insertion Sort https://www.hackerrank.com/contests/17cs1102/challenges/3-a-implement-insertion-sort	3	Chalk	--- NOT APPLICABLE ---
30	Quick Sort https://www.hackerrank.com/contests/17cs1102/challenges/4a-quick-sort	3	Chalk	--- NOT APPLICABLE ---
30	Merge Sort https://www.hackerrank.com/contests/17cs1102/challenges/merge-sort-6	3	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 2

Session Outcome: 1 Students able to implement quick sort

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
40	Implement Shell Sort https://www.hackerrank.com/contests/17cs1102/challenges/3b-implement-shell-sort	3	Chalk	--- NOT APPLICABLE ---
30	Insertion Sort https://www.codechef.com/DSCA2019/problems/NSECDS03	3	Chalk	--- NOT APPLICABLE ---
40	Quick sort 1 – Partition https://www.hackerrank.com/challenges/quicksort1/problem	3	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 3

Session Outcome: 1 Students able to implement merge sort technique

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Quick Sort https://www.codechef.com/DSCA2019/problems/NSECDS06/	3	Chalk	--- NOT APPLICABLE ---
35	Max Power https://www.hackerearth.com/practice/algorithms/sorting/quick-sort/practice-problems/algorithm/increasing-subsequence-fbb63e3c/	3	Chalk	--- NOT APPLICABLE ---
30	Maximum Sum of Building Speed https://www.hackerearth.com/practice/algorithms/sorting/merge-sort/practice-problems/algorithm/maximum-sum-of-building-speed-00ab8996/	3	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 4

Session Outcome: 1 Students able to implement singly linked list operations

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	nserting a Node Into a Sorted Doubly Linked List https://www.hackerrank.com/challenges/insert-a-node-into-a-sorted-doubly-linked-list/problem?h_r=internal-search	3	Chalk	--- NOT APPLICABLE ---
35	Delete duplicate-value nodes from a sorted linked list https://www.hackerrank.com/challenges/delete-duplicate-value-nodes-from-a-sorted-linked-list/problem?h_r=internal-search	3	Chalk	--- NOT APPLICABLE ---
30	Find the middle of a given linked list using recursion https://www.hackerearth.com/problem/algorithm/find-the-middle-of-a-given-linked-list-using-recursion/	3	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 5

Session Outcome: 1 Students able to implement doubly linked list and circular linked list

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Reverse a List https://www.hackerrank.com/challenges/fp-reverse-a-list/problem?h_r=internal-search	3	Chalk	--- NOT APPLICABLE ---
35	Reverse a doubly linked list https://www.hackerrank.com/challenges/one-month-preparation-kit-reverse-a-doubly-linked-list/problem?h_r=internal-search	3	Chalk	--- NOT APPLICABLE ---
30	Circular Doubly Linked list https://www.hackerearth.com/problem/algorithm/hiddent-doubly-linked-liste8c1fead/	3	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 6

Session Outcome: 1 Students able to implement stack using singly linked list

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods

35	Maximum Element https://www.hackerrank.com/challenges/maximum-element/problem?isFullScreen=true	3	Chalk	--- NOT APPLICABLE ---
35	qual Stacks https://www.hackerrank.com/challenges/equal-stacks/problem?isFullScreen=true	3	Chalk	--- NOT APPLICABLE ---
30	Waiter https://www.hackerrank.com/challenges/waiter/problem?isFullScreen=true	4	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 7

Session Outcome: 1 Students able to implement queue using singly linked list

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Max in Queue https://www.hackerearth.com/practice/data-structures/trees/heapspriority-queues/practice-problems/algorithm/queues-content-problem/	3	Chalk	--- NOT APPLICABLE ---
35	Code Queue https://www.codechef.com/problems/KCPROG4	3	Chalk	--- NOT APPLICABLE ---
30	Circular Queue using Arrays https://www.hackerrank.com/contests/17cs1102/challenges/7a-circular-queue-using-arryas	3	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 8

Session Outcome: 1 Students able to implement stack applications

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	ostfix Expression Evaluation https://www.hackerrank.com/contests/17cs1102/challenges/8-c-postfix-expression-evaluation/problem	3	Chalk	--- NOT APPLICABLE ---
35	nfix to Postfix https://www.codechef.com/problems/INFPOS03	3	Chalk	--- NOT APPLICABLE ---
30	Check for balanced parentheses in an expression https://www.hackerrank.com/contests/the-great-programming-challange/challenges/check-for-balanced-parentheses-in-an-expression	3	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 9

Session Outcome: 1 Students able to implement different hashing techniques

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Unusual construction https://www.hackerearth.com/practice/data-structures/hash-tables/basics-of-hash-tables/practice-problems/algorithm/unusual-construction-3ec2e03f/	3	Chalk	--- NOT APPLICABLE ---
35	ount Pairs https://www.hackerearth.com/practice/data-structures/hash-tables/basics-of-hash-tables/practice-pproblems/algorithm/count-pairs-9-d69fcdc3/	3	Chalk	--- NOT APPLICABLE ---
30	Pairs of elements https://www.hackerearth.com/practice/data-structures/hash-tables/basics-of-hash-tables/practice-problems/algorithm/t-rex-and-the-pairs-0a045ce2/	3	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 10

Session Outcome: 1 Students able to implement binary search tree operations

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Preorder Traversal https://www.hackerrank.com/challenges/one-week-preparation-kit-tree-preorder-traversal/problem?h_r=internal-search	3	Chalk	--- NOT APPLICABLE ---
35	Binary Search Tree : Insertion https://www.hackerrank.com/challenges/binary-search-tree-	3	Chalk	--- NOT APPLICABLE ---

	insertion/problem			
30	Binary Search Trees https://www.hackerrank.com/challenges/30-binary-search-trees/problem	3	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 11

Session Outcome: 1 Students able to implement avl tree operations

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	VL Tree https://www.codechef.com/problems/UCS616A2	3	Chalk	--- NOT APPLICABLE ---
35	Chef and Tree https://www.codechef.com/problems/CHEFTRE	3	Chalk	--- NOT APPLICABLE ---
30	Chef and Average on a Tree https://www.codechef.com/problems/L56AVG	3	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 12

Session Outcome: 1 Students able to implement graph traversing techniques

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Analyze why topological sorting can be applicable to Directed acyclic Graphs(DAG).Apply topological sorting for the given graph	3	Chalk	--- NOT APPLICABLE ---
35	Construct the weighted directed graph represented by the adjacency matrix given below. A non-zero value at [row, column] indicates that the vertex in the row is adjacent to the vertex in the column and apply DFS to the graph	3	Chalk	--- NOT APPLICABLE ---
30	Apply prims's algorithm to find minimum spanning tree from node1 to all other nodes for the following graph	3	Chalk	--- NOT APPLICABLE ---

Skilling Course DELIVERY Plan:

Skilling session no	Topics/Experiments	CO-Mapping
1	Insertion Sort and Shell Sort	CO1
2	Insertion Sort and Shell Sort	CO1
3	Quick Sort	CO1
4	Quick sort	CO1
5	Merge Sort	CO1
6	Merge Sort	CO1
7	Singly Linked List	CO2
8	Singly Linked List	CO2
9	Doubly Linked List and Circular Linked List	CO2
10	Doubly Linked List and Circular Linked List	CO2
11	Stack	CO2
12	Stack	CO2
13	Queue	CO2

Skilling session no	Topics/Experiments	CO-Mapping
14	Queue	CO2
15	Stack Applications	CO2
16	Stack Applications	CO2
17	Hashing	CO3
18	Hashing	CO3
19	Binary Search tree	CO3
20	Binary Search tree	CO3
21	AVL Tree	CO3
22	AVL Tree	CO3
23	Graphs	CO4
24	Graphs	CO4

Skilling Session wise Teaching – Learning Plan

SESSION NUMBER : 1

Session Outcome: 1 Insertion Sort and Shell Sort

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Merge Sort: Counting Inversions https://www.hackerrank.com/challenges/ctci-merge sort/problem?h_r=internal-search	5	Chalk	--- NOT APPLICABLE ---
35	Insertion Sort - Part 1 https://www.hackerrank.com/challenges/insertionsort1/problem	5	Chalk	--- NOT APPLICABLE ---
30	DESORT https://www.codechef.com/problems/DSORT	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 2

Session Outcome: 1 Insertion Sort and Shell Sort

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Frog Sort https://www.codechef.com/problems/FROGS	5	Chalk	--- NOT APPLICABLE ---
35	Problem Sort https://www.codechef.com/problems/PROBLEMS	5	Chalk	--- NOT APPLICABLE ---
30	Suffix Sort https://www.codechef.com/problems/ICM0001	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 3

Session Outcome: 1 Quick Sort

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Sorting Tool https://www.codechef.com/problems/KJCP01	5	Chalk	--- NOT

				APPLICABLE ---
35	Willows Sort https://www.codechef.com/problems/WISORT	5	Chalk	--- NOT APPLICABLE ---
30	Radix Sort https://www.codechef.com/problems/RDX	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 4

Session Outcome: 1 Quick sort

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Insertion Sort - Part 2 https://www.hackerrank.com/challenges/insertionsort2/problem	5	Chalk	--- NOT APPLICABLE ---
35	Correctness and the Loop Invariant https://www.hackerrank.com/challenges/correctness invariant/problem	5	Chalk	--- NOT APPLICABLE ---
30	Merge Sorted Array https://leetcode.com/problems/merge-sorted-array/	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 5

Session Outcome: 1 Merge Sort

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Sam Height https://www.hackerearth.com/practice/algorithms/sorting/merge sort/practice-problems/algorithm/alice-and-marks-hsbc-b1	5	Chalk	--- NOT APPLICABLE ---
35	Median Game https://www.hackerearth.com/practice/algorithms/sorting/merge sort/practice-problems/algorithm/median-game-june-easy-19- 3722be60/	5	Chalk	--- NOT APPLICABLE ---
30	Friendly Neighbors https://www.hackerearth.com/practice/algorithms/sorting/merge sort/practice-problems/algorithm/choose-one-c4672347/	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 6

Session Outcome: 1 Merge Sort

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Different queries https://www.hackerearth.com/practice/algorithms/sorting/merge sort/practice-problems/algorithm/jumbled-queries-afb23321/	5	Chalk	--- NOT APPLICABLE ---
35	Let's swap https://www.hackerearth.com/practice/algorithms/sorting/merge sort/practice-problems/algorithm/lets-swap-5075ade8/	5	Chalk	--- NOT APPLICABLE ---
30	Specialty of a sequence https://www.hackerearth.com/practice/algorithms/sorting/quick sort/practice-problems/algorithm/lex-finds-beauty-0d0bc1b6/	4	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 7

Session Outcome: 1 Singly Linked List

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Print the Elements of a Linked List https://www.hackerrank.com/challenges/print-the-elements of-a-linked-list/problem?h_r=internal-search	5	Chalk	--- NOT APPLICABLE ---

35	Linked list https://www.codechef.com/problems/REC_05	5	Chalk	--- NOT APPLICABLE ---
30	Insert a Node at the Tail of a Linked List https://www.hackerrank.com/challenges/insert-a-node-at the-tail-of-a-linked-list/problem?h_r=internal-search	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 8

Session Outcome: 1 Singly Linked List

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Delete a Node https://www.hackerrank.com/challenges/delete-a-node-from a-linked-list/problem?h_r=internal-search	5	Chalk	--- NOT APPLICABLE ---
35	Remove Kth Node https://www.hackerearth.com/problem/algorithm/remove-kth node/	5	Chalk	--- NOT APPLICABLE ---
30	Compare two linked lists https://www.hackerrank.com/challenges/compare-two-linked lists/problem?h_r=internal-search	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 9

Session Outcome: 1 Doubly Linked List and Circular Linked List

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Remove Friends https://www.hackerearth.com/practice/data-structures/linked list/singly-linked-list/practice-problems/algorithm/remove friends-5/	5	Chalk	--- NOT APPLICABLE ---
35	Cycle Detection https://www.hackerrank.com/challenges/detect-whether-a linked-list-contains-a-cycle/problem?	5	Chalk	--- NOT APPLICABLE ---
30	Reverse a linked list https://www.hackerrank.com/challenges/reverse-a-linked list/problem?h_r=internal-search	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 10

Session Outcome: 1 Doubly Linked List and Circular Linked List

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Merge two sorted linked list https://www.hackerrank.com/challenges/merge-two-sorted linkedlists/problem	5	Chalk	--- NOT APPLICABLE ---
35	Insert a node at the head of a linked list https://www.hackerrank.com/challenges/insert-a-node-at the-head-of-a-linked-list/problem?h_r=internal-search	5	Chalk	--- NOT APPLICABLE ---
30	Get Node Value https://www.hackerrank.com/challenges/get-the-value-of the-node-at-a-specific-position-from-the-tail/problem? h_r=internal-search	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 11

Session Outcome: 1 Stack

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Sudhanva and Books https://www.hackerrank.com/challenges/waiter/problem? isFullScreen=true	5	Chalk	--- NOT APPLICABLE ---
35	Simple stack https://www.hackerearth.com/problem/algorithm/simple stack/	5	Chalk	--- NOT APPLICABLE ---
30	Stack operations https://www.hackerearth.com/practice/data structures/stacks/basics-of-stacks/practice problems/algorithm/stakth-1-e6a76632/	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 12

Session Outcome: 1 Stack

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Stack using arrays https://www.hackerearth.com/problem/algorithm/stack-using arrays-2/	5	Chalk	--- NOT APPLICABLE ---
35	Mayank and his stacks https://www.hackerearth.com/problem/algorithm/mayank and-his-stacks/	5	Chalk	--- NOT APPLICABLE ---
30	Queues and Stacks https://www.hackerrank.com/challenges/30-queues stacks/problem?h_r=internal-search	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 13

Session Outcome: 1 Queue

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Chefs in Queue https://www.codechef.com/problems/CHFQUEUE	5	Chalk	--- NOT APPLICABLE ---
35	Dr Phil goes to the ranch https://www.codechef.com/problems/CAC202	5	Chalk	--- NOT APPLICABLE ---
30	Queue Problem https://www.hackerearth.com/problem/algorithm/queue problem-jatinj-1addbbb7/	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 14

Session Outcome: 1 Queue

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Aniruddha's Queue https://www.hackerearth.com/practice/basic programming/implementation/basics-of implementation/practice-problems/algorithm/aniruddhas queue-4/	5	Chalk	--- NOT APPLICABLE ---
35	queue-using-two-stacks https://www.hackerrank.com/challenges/queue-using-two stacks/problem?isFullScreen=true	5	Chalk	--- NOT APPLICABLE ---
30	Long ATM Queue https://www.hackerearth.com/practice/data structures/arrays/1-d/practice-problems/algorithm/long-atm queue-3/	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 15

Session Outcome: 1 Stack Applications

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Transform the expression https://www.hackerearth.com/problem/algorithm/transform the-expression-2/	5	Chalk	--- NOT APPLICABLE ---
35	Check for balanced parentheses in an expression https://www.hackerrank.com/contests/the-great-programming challange/challenges/check-for-balanced-parentheses-in-an expression	5	Chalk	--- NOT APPLICABLE ---
30	Balanced Brackets https://www.hackerrank.com/contests/cs1300-odd 2014/challenges/evaluate-expression/problem	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 16

Session Outcome: 1 Stack Applications

Time(min)	Topic	BTL	Teaching-	Active Learning

			Learning Methods	Methods
35	Stack and Queue https://www.hackerearth.com/practice/data structures/stacks/basics-of-stacks/practice problems/algorithm/staque-1-e790a29f/	5	Chalk	--- NOT APPLICABLE ---
35	Disk tower https://www.hackerearth.com/practice/data structures/queues/basics-of-queues/practice problems/algorithm/disk-tower-b7cc7a50/	5	Chalk	--- NOT APPLICABLE ---
30	Infix to Postfix https://www.codechef.com/problems/INFPOS03	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 17

Session Outcome: 1 Hashing

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Plot the Curve https://www.hackerearth.com/practice/data-structures/hash tables/basics-of-hash-tables/practice problems/algorithm/lets-plot-this-47a575ed/	5	Chalk	--- NOT APPLICABLE ---
35	Similar Chocolates https://www.hackerearth.com/practice/data-structures/hash tables/basics-of-hash-tables/practice problems/algorithm/notebook-pages-dbad75a5/	5	Chalk	--- NOT APPLICABLE ---
30	Maximum Sum https://www.hackerearth.com/practice/data-structures/hash tables/basics-of-hash-tables/practice problems/algorithm/maximum-subarray-sum-of-subarrays 7f33aefa/	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 18

Session Outcome: 1 Hashing

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Festivals https://www.hackerearth.com/practice/data-structures/hash tables/basics-of-hash-tables/practice problems/algorithm/suzakus-festivals-14dacd7c/	5	Chalk	--- NOT APPLICABLE ---
35	Bob and String https://www.hackerearth.com/practice/data-structures/hash tables/basics-of-hash-tables/practice problems/algorithm/bob-and-string-easy/	5	Chalk	--- NOT APPLICABLE ---
30	ICPC Team Management https://www.hackerearth.com/practice/data-structures/hash tables/basics-of-hash-tables/practice problems/algorithm/icpc-team-management/	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 19

Session Outcome: 1 Binary Search tree

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Skill Session https://www.codechef.com/problems/ONP	5	Chalk	--- NOT APPLICABLE ---
35	Count Number of Leaf Nodes in a tree https://www.hackerearth.com/problem/algorithm/count-leaf nodes-in-a-binary-tree/	5	Chalk	--- NOT APPLICABLE ---
30	Tree: Inorder Traversal https://www.hackerrank.com/challenges/tree-inorder traversal/problem?h_r=internal-search	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 20

Session Outcome: 1 Binary Search tree

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods

35	Monk and his Friends https://www.hackerearth.com/practice/data structures/trees/binary-search-tree/practice problems/algorithm/monk-and-his-frien	5	Chalk	--- NOT APPLICABLE ---
35	Tree: Post-order Traversal https://www.hackerrank.com/challenges/tree-postorder traversal/problem	5	Chalk	--- NOT APPLICABLE ---
30	Create BST https://www.hackerearth.com/practice/data structures/trees/binary-search-tree/practice problems/algorithm/create-bst/	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 21

Session Outcome: 1 AVL Tree

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Balanced Tree https://www.hackerearth.com/problem/algorithm/balanced tree/	5	Chalk	--- NOT APPLICABLE ---
35	Construct AVL Tree for the following sequence of numbers - 52 , 64 , 76 , 5 , 18 , 33 , 55 , 34 , 11 ,20, 48	5	Chalk	--- NOT APPLICABLE ---
30	Construct an AVL tree with the following node values: 13, 10, 7, 30, 35, 5, 3 and identify the single left rotations	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 22

Session Outcome: 1 AVL Tree

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Explain AVL Tree and advantages of AVL Tree in the data organization. What is a balancing factor? And its importance to improve the efficiency of tree organization. Representing AVL tree as balanced binary search tree.	5	Chalk	--- NOT APPLICABLE ---
35	Construct AVL Tree for the following sequence of numbers -50, 20 , 60 , 10 , 8 , 15 , 32 , 46 , 11 , 48. Explain the process of deleting the node 32	5	Chalk	--- NOT APPLICABLE ---
30	Construct AVL Tree for the following sequence of numbers - 50 , 20 , 60 , 10 , 8 , 15 , 32 , 46 , 11 , 48	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 23

Session Outcome: 1 Graphs

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	BFS: Shortest Reach in a Graph https://www.hackerrank.com/challenges/ctci-bfs-shortest reach/problem	5	Chalk	--- NOT APPLICABLE ---
35	DFS Edges https://www.hackerrank.com/challenges/dfs-edges/problem	5	Chalk	--- NOT APPLICABLE ---
30	Kruskal (MST): Really Special Subtree https://www.hackerrank.com/challenges/kruskalmstrsub/problem	5	Chalk	--- NOT APPLICABLE ---

SESSION NUMBER : 24

Session Outcome: 1 Graphs

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
35	Prim's (MST) : Special Subtree https://www.hackerrank.com/challenges/primsmstsub/problem	5	Chalk	--- NOT APPLICABLE ---
35	Finding pairs https://www.hackerearth.com/practice/algorithms/graphs/depth first-search/practice-problems/algorithm/find-pairs/	5	Chalk	--- NOT APPLICABLE ---
30	Build a graph https://www.hackerearth.com/practice/algorithms/graphs/graph representation/practice-	5	Chalk	--- NOT APPLICABLE

	problems/algorithm/build-a-graph 5f5c6b4a/			---

WEEKLY HOMEWORK ASSIGNMENTS/ PROBLEM SETS/OPEN ENDEDED PROBLEM-SOLVING EXERCISES etc:

Week	Assignment Type	Assignment No	Topic	Details	co

COURSE TIME TABLE:

	Hour	1	2	3	4	5	6	7	8	9
Day	Component									
Mon	Theory	H-S1	H-S1	H-S2	--	--	---	---	H-S3	---
	Tutorial	--	--	--	--	--	---	---	--	---
	Lab	--	--	--	H-S2	H-S2	---	---	--	---
	Skilling	H-S3	H-S3	--	--	--	---	---	--	---
Tue	Theory	---	---	---	H-S3	H-S3	--	--	---	---
	Tutorial	---	---	---	--	--	--	--	---	---
	Lab	---	---	---	--	--	--	--	---	---
	Skilling	---	---	---	H-S2	H-S2	H-S1	H-S1	---	---
Wed	Theory	H-S2	H-S2	--	--	---	---	---	---	---
	Tutorial	--	--	--	--	---	---	---	---	---
	Lab	H-S3	H-S3	H-S1	H-S1	---	---	---	---	---
	Skilling	--	--	--	--	---	---	---	---	---
Thu	Theory	---	---	---	--	--	---	---	H-S1	---
	Tutorial	---	---	---	--	--	---	---	--	---
	Lab	---	---	---	--	--	---	---	--	---
	Skilling	---	---	---	H-S1,H-S2	H-S1,H-S2	---	---	--	---
Fri	Theory	--	--	---	---	---	---	---	---	---
	Tutorial	--	--	---	---	---	---	---	---	---
	Lab	--	--	---	---	---	---	---	---	---
	Skilling	H-S3	H-S3	---	---	---	---	---	---	---
Sat	Theory	--	--	--	--	--	--	--	--	--
	Tutorial	--	--	--	--	--	--	--	--	--
	Lab	--	--	--	--	--	--	--	--	--
	Skilling	--	--	--	--	--	--	--	--	--
Sun	Theory	--	--	--	--	--	--	--	--	--
	Tutorial	--	--	--	--	--	--	--	--	--
	Lab	--	--	--	--	--	--	--	--	--
	Skilling	--	--	--	--	--	--	--	--	--

REMEDIAL CLASSES:

Supplement course handout, which may perhaps include special lectures and discussions that would be planned, and schedule notified according

SELF-LEARNING:

Assignments to promote self-learning, survey of contents from multiple sources.

S.no	Topics	CO	ALM	References/MOOCS

DELIVERY DETAILS OF CONTENT BEYOND SYLLABUS:

Content beyond syllabus covered (if any) should be delivered to all students that would be planned, and schedule notified accordingly.

S.no	Advanced Topics, Additional Reading, Research papers and any	CO	ALM	References/MOOCS

EVALUATION PLAN:

Evaluation Type	Evaluation Component	Weightage/Marks		Assessment Dates	Duration (Hours)	CO1	CO2	CO3	CO4	CO5
End Semester Summative Evaluation Total= 40 %	Skill Sem-End Exam	Weightage	8		120					8
		Max Marks	50							50
	End Semester Exam	Weightage	24		180	6	6	6	6	
		Max Marks	100			25	25	25	25	
	Lab End Semester Exam	Weightage	8		120					8
		Max Marks	50							50
In Semester Formative Evaluation Total= 26 %	Ratings on Global Platforms	Weightage	4		120					4
		Max Marks	50							50
	Skilling Continuous Evaluation	Weightage	4		120	1	1	1	1	
		Max Marks	50			12.5	12.5	12.5	12.5	
	ALM	Weightage	8		20	2	2	2	2	
		Max Marks	50			12.5	12.5	12.5	12.5	
	Home Assignment and Textbook	Weightage	4		20	1	1	1	1	
		Max Marks	50			12.5	12.5	12.5	12.5	
	Continuous Evaluation - Lab Exercise	Weightage	6		120					6
		Max Marks	50							50
In Semester Summative Evaluation Total= 34 %	Semester in Exam-I	Weightage	12		120	6	6			
		Max Marks	50			25	25			
	Semester in Exam-II	Weightage	12		120			6	6	
		Max Marks	50					25	25	
	Lab In Semester Exam	Weightage	5		120					5
		Max Marks	50							50
	Skill In-Sem Exam	Weightage	5		120	1	2	2		
		Max Marks	50			10	20	20		

ATTENDANCE POLICY:

Every student is expected to be responsible for regularity of his/her attendance in class rooms and laboratories, to appear in scheduled tests and examinations and fulfill all other tasks assigned to him/her in every course
In every course, student has to maintain a minimum of 85% attendance to be eligible for appearing in Semester end examination of the course, for cases of medical issues and other unavoidable circumstances the students will be condoned if their attendance is between 75% to 85% in every course, subjected to submission of medical certificates, medical case file and other needful documental proof to the concerned departments

DETENTION POLICY :

In any course, a student has to maintain a minimum of 85% attendance and In-Semester Examinations to be eligible for appearing to the Semester End Examination, failing to fulfill these conditions will deem such student to have been detained in that course.

PLAGIARISM POLICY :

Supplement course handout, which may perhaps include special lectures and discussions

COURSE TEAM MEMBERS, CHAMBER CONSULTATION HOURS AND CHAMBER VENUE DETAILS:

Supplement course handout, which may perhaps include special lectures and discussions

Name of Faculty	Delivery Component of Faculty	Sections of Faculty	Chamber Consultation Day (s)	Chamber Consultation Timings for each day	Chamber Consultation Room No:	Signature of Course faculty:
G REKHA	L	3-MA	-	-	-	-
G REKHA	P	3-MA	-	-	-	-
LINGAM SUNITHA	L	2-MA	-	-	-	-
LINGAM	P	2-MA	-	-	-	-

SUNITHA						
LINGAM SUNITHA	S	2-MA	-	-	-	-
Krishnamurthy Ramasubramanian	S	3-MA	-	-	-	-
Shreya Rachala	P	1-MA	-	-	-	-
Shreya Rachala	S	1-MA	-	-	-	-
Giridhar Urkude	L	1-MA	-	-	-	-

GENERAL INSTRUCTIONS

Students should come prepared for classes and carry the text book(s) or material(s) as prescribed by the Course Faculty to the class.

NOTICES

Most of the notices are available on the LMS platform.

All notices will be communicated through the institution email.

All notices concerning the course will be displayed on the respective Notice Boards.

Signature of COURSE COORDINATOR

(LINGAM SUNITHA)

Signature of Department Prof. Incharge Academics & Vetting Team Member

Department Of DBES-1

HEAD OF DEPARTMENT:

Approval from: DEAN-ACADEMICS
(Sign with Office Seal) [object HTMLDivElement]