

22EE460 DATA STRUCTURES

Category L T P Credit

ESC 2 1 0 3

Preamble

This course will cover various data structures and their operations for manipulating them. Students will learn how to organize the data so that, the data can be accessed and updated efficiently using computer programs.

Prerequisite

- 22EE350 Problem Solving using Computers

Course Outcomes

On the successful completion of the course, students will be able to

COs	Course Outcome Statement	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Use suitable linear data structures and their operations for solving a given problem	TPS3	80	85
CO2	Use suitable non-linear data structures like Trees and their operations for solving a given problem	TPS3	80	85
CO3	Use suitable non-linear data structures like Hash Table, Graph and their operations for solving a given problem	TPS3	80	85
CO4	Compute space and time complexity of a given problem	TPS3	80	85
CO5	Interpret computational efficiency of searching and sorting algorithms	TPS3	80	85
CO6	Formulate solutions by identifying suitable ADTs for solving problems using suitable programming languages	TPS3	80	85

Mapping with Programme Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	S	M	L					L				M			
CO2	S	M	L					L				M			
CO3	S	M	L					L				M			
CO4	S	M	L					L				M			
CO5	S	M	L					L				M			
CO6	S	M	L		M			L				M			

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT1						CAT2						Terminal					
TPS Scale	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
CO1	10	15	25										6	10	10			
CO2							5	10	20				6	10	10			
CO3							5	10	10				2	5	5			
CO4	5		10										2		8			
CO5		5	10						10				4	5	5			
CO6			20						30						12			

Assignments include solving worksheets, quiz, problem solving using Programming languages.

Syllabus

Data Abstraction: Data Representation - Types of Data Structures - Abstract Data Type

Linear ADTs: List - Arrays - Matrix - String - Applications –Array Problems, Matrix Problems, Strings problems

Stack - Queue - Circular Queue - Linked List - Singly Linked List, Doubly Linked List, Circular Linked List - Applications - Expression evaluation, Polynomial Evaluation, Josephus Problem, Middle Number, Palindrome checking – Recursion – Fibonacci, GCD

Non-linear ADTs: Tree Terminology - Binary tree - Tree traversals - Expression Tree – Binary Search Tree - AVL Tree - B-tree - Binary Heap - Applications – Dictionary, kth smallest element, Hash Table – Hashing Techniques, Rehashing–Graphs –Graph Terminology – Graph Representation – Graph traversals – Applications –Shortest path algorithm, Minimum Spanning Tree

Algorithm Analysis: Asymptotic Measures – Space Complexity – Time Complexity

Searching and Sorting: Searching Techniques - Sequential Search, Binary Search, Search trees – Sorting Techniques – Bubble Sort, Insertion Sort, Selection Sort, Shell Sort, Quick Sort, Merge Sort, Heap Sort

Text Book

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2012.
2. Richard Gilberg, Behrouz A. Forouzan, "Data Structures: A Pseudo code Approach with C", Second edition, India Edition 2007.

Reference Books & web resources

1. M. A. Weiss, "Data Structures and Algorithm Analysis in Java", Second Edition, Pearson Education, 2014
2. Aho, J.E. Hopcroft and J.D. Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
3. Basant Agarwal, Benjamin Baka, "Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2nd Edition, 2018
4. SWAYAM / NPTEL's Course for Data Structures – http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/data_str_algo/frameset.htm
5. Web Reference for Data Structures – <https://www.geeksforgeeks.org/data-structures>
6. Web Reference for Data Structures – <https://www.hackerrank.com/domains/data-structures>
7. Web Reference for Data Structures – www.leetcode.com/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Data Abstraction	
1.1	Data Representation	1
1.2	Types of Data Structures	
1.3	Abstract Data Type (ADT)	
2	Linear ADTs	
2.1	List – Arrays, Matrix, String	2
2.2	Applications – Array Problems, Matrix Problems, Strings problems	1
2.3	Stack ADT	2
2.4	Queue ADT	1
2.5	Circular Queue ADT	1
2.6	Linked List – Singly, Double, Circular Lists	3
2.7	Applications – Expression evaluation, Polynomial Evaluation, Josephus Problem, Middle Number, Palindrome checking	2
2.8	Recursion – Fibonacci, GCD	1
3	Non-linear ADTs: - Graphs – Graph Terminology –	
3.1	Trees	
3.1.1	Trees Terminology	1
3.1.2	Binary Tree traversals	1
3.1.3	Expression Tree	1
3.1.4	Binary Search Tree	2
3.1.5	AVL Tree	2
3.1.6	B-tree	2
3.1.7	Binary Heap	2
3.1.8	Applications – Dictionary, kth smallest element	1
3.2	Hash Table	
3.2.1	Hashing Techniques	2
3.2.2	Rehashing	

Module No.	Topic	No. of Periods
3.3	Graph	
3.3.1	Graph Terminology	1
3.3.2	Graph Representation	
3.3.3	Graph traversals	
3.3.4	Applications – Shortest path algorithm, Minimum Spanning Tree	2
4	Algorithm Analysis:	
4.1	Asymptotic Measures	1
4.2	Space Complexity	
4.3	Time Complexity	
5	Searching and Sorting	
5.1	Searching Techniques	
5.1.1	Sequential Search	1
5.1.2	Binary Search	
5.1.3	Search trees	
5.2	Sorting Techniques	
5.2.1	Bubble Sort	1
5.2.2	Insertion Sort	
5.2.3	Selection Sort	
5.2.4	Shell Sort	1
5.2.5	Quick Sort	
5.2.6	Merge Sort	1
5.2.7	Heap Sort	
Total Lecture Hours		36

Course Designer(s):

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