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|---|---------------------|---|---|------------|------------|---------------------|------------|-----------------------|----------------------|---------------------|
| Course Title | Data Structures | | Course No <i>(Will be assigned)</i> | | | | | | | |
| Specialization | | | Structure | | | | | | | |
| Course/ Branch | CSE | | | L | T | P | C | | | |
| Offered for | 3 rd Sem | | | 3 | 0 | 0 | 3 | | | |
| Faculty | E & T | | Status | BSC | HSC | ESC | PCC | Prof. Elective | Open Elective | Minor (Hons) |
| Pre-requisite | Y | N | | - | - | | - | - | - | - |
| | - | - | | Project/ | | Seminar | | Internship | | Mandatory |
| | - | - | | - | | - | | - | | - |
| For Office Use Only | | | | | | | | | | |
| Date of Submission | | | Type | New | | Modification | | Merging | | |
| To take effect from | | | | | | | | | | |
| Date of approval by Board of Study | | | Date of approval by Academic Council | | | | | | | |

HoD

Director

Dean

| Sr No | Name of Course | Teaching Scheme | | | | Evaluation Scheme | | | | | | | | | | | Credits | |
|----------|--------------------|----------------------|------------------------|-------------------------|------------|--------------------------|-------------------|-------------|----|----|-----------|---|---|----------|-------------------------|--------|-----------|---|
| | | Theory Hours/week | Tutorial Hours/week | Practical Hours/week | Total | Theory | | | | | Practical | | | | Total Marks | Theory | Practical | |
| | | | | | | Ex | Internal | | | | Internal | | | External | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | Continuous Evaluation | | | | | Term Work | | | | Viva/ Practical Exam | | | |
| ESS | Attendance | Assignment | Mid Sem -I | Mid Sem -II | Attendance | Lab work | Report Writing | Performance | | | | | | | | | | |
| 1 | Data Structures | 3 | 0 | 0 | 3 | 70 | 5 | 5 | 10 | 10 | - | - | - | - | - | 100 | 3 | - |

Course Outcomes:

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|------------|--|
| CO1 | Define and classify various data structures, storage structures and common operations on them |
| CO2 | Create various linear data structures with their representation and perform different operations on them |
| CO3 | Create various nonlinear data structures with their representation and perform different operations on them |
| CO4 | Apply various searching sorting techniques on data set and compare them |
| CO5 | Solve the given problem using an appropriate data structure to achieve optimal performance and compare its performance with other possible data structures |

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| Content of the Course | | |
|------------------------------|---|--------------|
| Module | Contents/ Topics to be covered | Hours |
| Module - 1 | Introduction to Data Structures Types of data structure. Linear and non-linear, Data types – Primitive and Non-Primitive, Application of data structure, Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best and worst case analysis), | 04 |
| Module - 2 | LINEAR DATA STRUCTURE Array: Representation of arrays, Applications of arrays, sparse matrix and its representation Stack and Queues Introduction of stack, Operations on stack, Applications of stack, Polish Expression, Reverse Polish Expression And Their Compilation, Infix to postfix conversion and Evaluation of postfix expression, Recursion implementation, Tower of Hanoi Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue Linked List Overview of linked list, Dynamic memory allocation, Linked list operations: Insert node, Delete node, Search node, traversal, copy linked list, merge linked list Types of linked list: Singly, Circular, Doubly, Sorted. Application of linked list, Introduction to object oriented programming through stacks, queues and linked lists | 13 |
| Module - 3 | NONLINEAR DATA STRUCTURE Tree: Tree: Introduction to tree, Representations of tree, Properties of trees, Binary tree, Binary tree representation, Binary tree properties, Binary tree traversals (inorder,preorder,postorder), Binary tree implementation, Threaded Binary Tree, Binary Search Tree, Conversion of General Tree to Binary Tree, Application of trees, Balanced tree mechanism, AVL Tree, 2-3 trees, Height Balance, Weight balance Graphs: Introduction to graph, Representation of Graphs, Breadth first search and Depth first search in directed and undirected graph , Spanning tree, shortest path, minimal spanning tree | 13 |
| Module - 4 | Sorting and Searching Time and space complexity, Introduction to sorting, Selection sort, Bubble sort, Insertion sort, Merge sort and Quick sort Sequential Search, Binary Search, Comparison of sorting and searching methods | 07 |
| Module - 5 | HASHING AND FILE STRUCTURES Hashing: The symbol table, Hashing Functions, Collision Resolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods. | 08 |

Textbooks

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| 1 | An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill |
| 2 | Data Structures using C & C++, Ten Baum, Prentice-Hall International |
| 3 | Fundamentals of Data Structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan Anderson-Freed, Universities Press. |
| 4 | Data Structures A Programming Approach with C, D.S.Kushwaha and A.K.Misra, PHI |
| 5 | Data Structure using C, Third edition, 2012, Reema Thareja, Oxford University press |
| 6 | Fundamentals of Computer Algorithms, 2001 edition, Horowitz, Sahni, Galgotia |

References

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| 1 | Data Structures: A Pseudo-code Approach with C, Gilberg & Forouzan, Thomson Learning |
| 2 | Data Structures and Algorithm Analysis in C, 2nd edition, M.A.Weiss, Pearson |

Web content Link / E- material links

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| 1 | NPTEL tutorials |
| 2 | www.coursera.org |
| 3 | www.geeksforgeeks.org/data-structures/ |
| 4 | Vlabs.iitb.ac.in |

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|---|----------------------------|---|---|------------|------------|---------------------|------------|-----------------------|----------------------|---------------------|
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| Offered for | 3 rd Sem | | | 0 | 0 | 4 | 2 | | | |
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| 1 | Data Structures Laboratory | 0 | 0 | 4 | 4 | - | - | - | - | - | 5 | 5 | 5 | 5 | 30 | 50 | 0 | 2 |

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List of Experiments

| Name of Laboratory: Data Structures Laboratory | | | | |
|---|---|--------------------|--------------|--------------------|
| List of practical/ Experiments | | | | |
| Sr No | Objective | Performance | Study | Self -Study |
| 1 | Implement a program to insert, delete and search an element from array. | YES | - | - |
| 2 | Introduction to pointers. Call by Value and Call by reference | YES | - | - |
| 3 | Implement a program for stack that performs following operations using array. a. PUSH b. POP c. PEEP d. CHANGE e. DISPLAY | YES | - | - |
| 4 | Implement a program to convert infix notation to postfix notation using stack | YES | - | - |
| 5 | Write a program to implement SIMPLE QUEUE and CIRCULAR QUEUE using arrays that performs following operations: a. INSERT b. DELETE c. DISPLAY | YES | - | - |
| 6 | Write a menu driven program to implement following operations on the singly linked list. a. Insert a node at the front of the linked list. b. Insert a node at the end of the linked list. c. Insert a node such that linked list is in ascending order d. Delete a first node of the linked list. e. Delete a node before specified position. f. Delete a node after specified position. | YES | - | - |
| 7 | Write a program to implement following operations on the doubly linked list. a. Insert a node at the front of the linked list. b. Insert a node at the end of the linked list. c. Delete a last node of the linked list. d. Delete a node before specified position | YES | - | - |
| 8 | Write a program to implement following operations on the circular linked list. a. Insert a node at the end of the linked list. b. Insert a node before specified position. c. Delete a first node of the linked list. d. Delete a node after specified position. | YES | - | - |

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| 9 | Write a program which create binary search tree and implement tree traversing methods in order, preorder and post-order traversal. | YES | - | - |
| 10 | Write a program to implement Following sorting algorithm a. Bubble b. Merge c. Quick | | | |
| 11 | Write a program to implement Binary search algorithm. | | | |
| 12 | OEP | YES | - | - |