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| --- | --- | --- | --- | --- | --- |
| **Name of The Course** | **Data Structures and Algorithms** | **L** | **T** | **P** | **C** |
| **Course Code** | **BCSE2361** | **2** | **0** | **2** | **3** |
| **Version No** |  | | | | |
| **Prerequisite** |  | | | | |
| **Co requisite** |  | | | | |
| **Anti- requisite** |  | | | | |

**Course Objectives:**

1. Introduce the fundamentals and abstract concepts of Data Structures.
2. Introduce searching, sorting techniques
3. Learn how concepts of data structures are useful in problem solving.

**Course Outcomes:**

Upon successful completion of this course, students will be able to

|  |  |
| --- | --- |
| **CO1** | Understand the comparison and use of Recursion and Loops |
| **CO2** | Understand the application of linear data structure(s) to solve various problems |
| **CO3** | Understand the application of non linear data structure(s) to solve various problems |
| **CO4** | Understand the shortest path algorithms involving complicated data structures like Graphs. |
| **CO5** | Become expert in calculating and comparing complexities of various searching and sorting algorithms. |
| **CO6** | Gain understanding of latest trends and research areas in the course |

**Text Books**

1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication

**Reference Books**

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein “Data Structures Using C and C++” , PHI
2. Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with applications”, McGraw Hill
3. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education
4. Lipschutz, “Data Structures” Schaum’s Outline Series, TMH
5. G A V Pai, “Data Structures and Algorithms”, TMH

**Course Content**

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| **Unit 1** | **Module 1** | **9 Hours** |
| Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big-Oh, Time-Space trade-off. Abstract Data Types (ADT)Arrays: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Application of arrays, Sparse Matrices and their representations. Linked lists: Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition, Generalized Linked List | | |
| **Unit II** | **Module 2** | **8 Hours** |
| Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Removal of recursion | | |
| **Unit III** | **Module 3** | **8 Hours** |
| Binary Trees, Binary Tree Representation: Array Representation and Dynamic Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Array and Linked Representation of Binary trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Threaded Binary trees, Traversing Threaded Binary trees, Huffman algorithm. | | |
| **Unit-IV** | **Module 4** | **7 Hours** |
| Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal : Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Dijikstra Algorithm | | |
| **Unit-V** | **Module 5** | **8 Hours** |
| Sequential search, Binary Search, Comparison and Analysis Internal Sorting: Insertion Sort, Selection, Bubble Sort, Shell sort. | | |
| **Unit-VI** | **Advancements and Research** | **6 Hours** |
| The advances and the latest trends in the course as well as the latest applications of the areas covered in the course. The latest research conducted in the areas covered in the course. Discussion of some latest papers published in IEEE transactions and ACM transactions, Web of Science and SCOPUS indexed journals as well as high impact factor conferences as well as symposiums. Discussion on some of the latest products available in the market based on the areas covered in the course and patents filed in the areas covered in the course. | | |

**CO-PO Mapping:**

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| Course Code | Name of Subject | **Course outcome description** | | | | | | | | | | | | | | | **Associate Bloom's Taxonomy (K1,K2,K3,K4,K5,K6)** |
| BCSE2361 | Data Structures and Algorithms | **CO1** | Understand the comparison and use of Recursion and Loops | | | | | | | | | | | | | | k2 |
| **CO2** | Understand the application of linear data structure(s) to solve various problems | | | | | | | | | | | | | | k2 |
| **CO3** | Understand the application of non linear data structure(s) to solve various problems | | | | | | | | | | | | | | k6 |
| **CO4** | Understand the shortest path algorithms involving complicated data structures like Graphs. | | | | | | | | | | | | | | k3 |
| **CO5** | Become expert in calculating and comparing complexities of various searching and sorting algorithms. | | | | | | | | | | | | | | k4 |
| **CO6** | Gain understanding of latest trends and research areas in the course | | | | | | | | | | | | | | k6 |
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| Affinity Label - | 0,1,2,3 |  |  |  |  |  |  |  |  |  |  |  |  |  | |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO1** | **PSO2** | |
|  | Program Outcomes(Numeric 1 to 3) | | | | | | | | | | | | | | Program Specific Outcome |
| **CO1** | 2 |  | 1 | 1 | 3 |  |  |  | 2 | 2 |  | 3 | 1 |  | |
| **CO2** | 2 |  |  |  |  |  |  |  | 1 | 1 |  | 2 |  |  | |
| **CO3** |  | 1 |  | 1 |  |  |  |  | 1 |  |  | 1 | 1 | 2 | |
| **CO4** |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |
| **CO5** |  | 1 |  |  |  |  |  |  |  |  |  |  |  | 2 | |
| **CO6** |  |  |  |  |  |  |  |  |  | 1 |  | 2 | 1 | 1 | |