**ADVANCED DATA STRUCTURES**

**SYLLABUS**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Course Code:** | 20CS3402 | **Year:** | II | **Semester:** | II |
| **Course Category:** | Professional Core Course | **Branch:** | CSE | **Course Type:** | Theory |
| **Credits:** | 3 | **L-T-P:** | 3-0-0 | **Prerequisites:** | Data Structures  (20ES1305), Object Oriented Programming through C++ (20CS3302) |
| **Continuous Internal Evaluation:** | 30 | **Semester End Evaluation:** | 70 | **Total Marks:** | 100 |

|  |  |  |
| --- | --- | --- |
| **COURSE OUTCOMES** | | |
| Upon successful completion of the course, Student will be able to | | |
| **CO1** | Understand the basic principles and operations of data structures. | **L2** |
| **CO2** | Apply Hashing, Disjoint sets and String Matching techniques for solving problems effectively. | **L3** |
| **CO3** | Apply the concepts of advanced Trees and Graphs for solving problems effectively. | **L3** |
| **CO4** | Analyze the given scenario and choose appropriate Data Structure for solving problems. | **L4** |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)** | | | | | | | | | | | | | | |
| **CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **CO2** | 2 |  |  |  |  |  |  |  | 1 | 1 |  | 1 | 1 | 1 |
| **CO3** | 2 |  |  |  |  |  |  |  | 1 | 1 |  | 1 | 1 | 1 |
| **CO4** |  | 2 |  |  |  |  |  |  | 1 | 1 |  | 1 |  | 1 |

|  |  |  |
| --- | --- | --- |
| **Unit No.** | **SYLLABUS CONTENTS** | **Mapped CO** |
| **I** | **Hashing –** General Idea, Hash Function, Separate Chaining, Hash Tables without linked lists: Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Hash Tables in the Standard Library, Universal Hashing, Extendible Hashing. | **CO1, CO2** |
| **II** | **Priority Queues (Heaps)** – Model, Simple implementations, Binary Heap: Structure Property, Heap Order Property, Basic Heap Operations: insert, delete, Percolate down, Other Heap Operations.  Binomial Queues: Binomial Queue Structure, Binomial Queue Operations, Implementation of Binomial Queue, Priority Queues in the Standard Library. | **CO1, CO3** |
| **III** | **Trees –** AVL: Single Rotation, Double Rotation, B-Trees.  **Multi-way Search Trees** **–** 2-3 Trees: Searching for an Element in a 2-3 Tree, Inserting a New Element in a 2-3 Tree, Deleting an Element from a 2-3 Tree.  **Red-Black Trees –** Properties of red-black trees,Rotations,Insertion, Deletion. | **CO1, CO3** |
| **IV** | **Graphs Algorithms –** Elementary Graph Algorithms: Topological sort, Single Source Shortest Path Algorithms: Dijkstra’s, Bellman-Ford, All-Pairs Shortest Paths: Floyd-Warshall’s Algorithm. | **CO1, CO3** |
| **V** | **Disjoint Sets –** Equivalence relation,Basic Data Structure, Simple Union and Find algorithms, Smart Union and Path compression algorithm.  **String Matching –** The naive string-matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm. | **CO1, CO2, CO4** |

|  |
| --- |
| **Learning Resources** |
| **Text Books** |
| 1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4th Edition, 2014, Pearson. 2. Introduction to Algorithms, Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3rd Edition, 2009, The MIT Press. |
| **References Text Book** |
| 1. Fundamentals of Computer Algorithms, Ellis Horowitz, SatrajSahani and Rajasekharam, 2nd Edition, 2009, University Press Pvt. Ltd. 2. Advanced Data Structures, Reema Thareja, S. Rama Sree, Oxford University Press, 2018. |
| **e-Resources and other Digital Material** |
| 1. http://www.coursera.org/learn/advanced-data-structures 2. http://ocw.mit.edu/6-851S12 (MITOPENCOURSEWARE, Massachusetts Institute of Technology) 3. https://nptel.ac.in/courses/106/106/106106133/ 4. https://www.mooc-list.com/search/node?keys=Advanced+Data+Structures 5. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms |