|  |  |
| --- | --- |
| MONO | **DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**  **NATIONAL INSTITUTE OF TECHNOLOGY PATNA**  Ashok Raj Path, PATNA 800 005 (Bihar), India |
| Phone No.: 0612 – 2372715, 2370419, 2370843, 2371929, 2371930, 2371715 Fax – 0612- 2670631 Website: [www.nitp.ac.in](http://www.nitp.ac.in/) |

***CS3401 Data Structures***

**L-T-P-Cr: 3-1-0-4**

**Pre-requisites:** Introduction to Computing

**Objectives/Overview:**

* To understand the different data structures.
* To learn which data structure should be used to make the algorithm simpler, easier to maintain, and faster.
* To improve the proficiency of students in applying the basic knowledge of programming to solve different problems.

**Course Outcomes:**

At the end of the course, a student should have:

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | **Outcome** | **Mapping to POs** |
|  | Understood the fundamentals of data structures. | PO2, PO3 |
|  | Learnt the set of operations that can be performed on the given data structure. | PO1, PO2 |
|  | Improved his/her skill of choosing the right data structure for a problem. | PO1, PO2 |
|  | Become proficient in using linear and non-linear data structures. | PO2, PO4 |
|  | Understood which searching and sorting technique best suits in the given scenario. | PO1, PO2 |
|  | Learnt to analyze and compare algorithms for efficiency using Big-O notation. | PO1, PO7 |

**UNIT I: Introduction Lectures: 5**

Characteristics of data structures, Creating, manipulating and operating on data structures, Types of data structures – linear and nonlinear. Introduction to algorithms: Asymptotic notations, Analysis of algorithms: Time complexity and Space complexity.

**UNIT II: Arrays Lectures: 5**

1-D arrays, multi-dimensional arrays, operating on arrays, Dynamic memory allocation, Storage – Column major order and Row major order, Address calculation of 1-D, 2-D, different form of matrix, Sparse Matrix. Linked lists – singly, doubly and circularly linked lists, operations on linked lists.

**UNIT III: Stacks Lectures: 5**

Basics of Stack data structure, Implementation of stack using array and linked list, Operations on

stacks, Applications of Stacks, Notations – infix, prefix and postfix, Conversion and evaluation

of arithmetic expressions using Stacks.

**UNIT IV: Queues Lectures: 3**

Basics of Queue data structure, Implementation of queue using array and linked list, Operations

on queues, Types of queues – queue, double ended queue, priority queue and Implementation of

these.

**UNIT V: Trees & Graph Lectures: 8**

Binary tree, Binary search tree, Threaded binary tree, AVL Tree, B Tree, Tries, Heaps, Hash tables. Graph and its implementation, Graph traversals: Breadth First Search, Depth First Search, Spanning Tree – Prim’s algorithm and Kruskal’s algorithm, Shortest path- Dijkstra's algorithm and Bellman Ford algorithm. Union-find data structure and applications, Topological sorting for Directed Acyclic Graph.

**UNIT VI: Searching and Sorting Lectures: 8**

Linear search, Binary search, Hashing. Algorithms and data structures for sorting: Insertion Sort, Bubble sort, Selection Sort, Merge sort, Quick Sort, Heap sort, Bucket sort.

**Text/Reference Books**

1. *Fundamentals of Data Structures.* E. Horowitz, S. Sahni, Computer Science Press, 2ndEdition, 2008
2. *Data Structure and Program Design*. by R. L Kruse, Prentice Hall, 2nd Edition, 1996