PARUL UNIVERSITY - Faculty of IT & Computer Science

Department of Computer Application

SYLLABUS FOR 1st Sem MCA, M.Sc. (IT) PROGRAMME

Data Structures (05201151)

Type of Course: MCA, M.Sc. (IT)

Prerequisite: Knowledge of programming language (C/C++).

Rationale: To provide understanding of basics of data structures and their operation for efficient storage and retrieval of data.

Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		External		Internal			
				T	P	T	CE	P	
4	0	2	5	60	30	20	20	20	150

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** - CE, **T** - Theory, **P** - Practical

Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1	**Introduction**: Primitive and non-primitive data structures, String manipulation and pattern matching, Storage representation of strings, Text handling, Key Word In Context (KWIC) indexing, Arrays, Storage structure for arrays, Special types of arrays – triangular and sparse.	10%	7
2	**Stack and Queue**: Stack, Stack operations, Applications of stack - recursion, polish notations - prefix, infix, postfix, Algorithms of stack applications, Introduction to queue, Algorithms and implementation of simple queue, Circular queue, Double ended queue, Priority queue.	20%	12
3	**Linked List**: Linked list, Algorithms and implementation of singly linked list, Doubly linked list, Circular linked list, Operations on linked list, Applications – polynomial representation, addition of two polynomials.	20%	8
4	**Trees**: Concept and terminologies of tree, General tree, Binary tree and its storage representation, Binary search tree and its operations – create, insert, delete, Traversal of tree - inorder, preorder, postorder, Threaded tree, B tree and B+ tree, Height balanced tree - AVL tree, Rotations in AVL tree, Applications – heap tree, expression tree.	20%	12

5	**Graph**: Concept and terminologies of graph, Representation of graph - adjacency matrix, adjacency lists, Introduction to graph traversal - Depth First Search (DFS), Breadth First Search (BFS), Introduction to spanning tree.	10%	5
6	**Searching, Sorting and Hashing**: Linear search, Binary search, Bubble sort, Selection sort, Insertion sort, Shell sort, Quick sort, Heap sort, Merge sort, Radix sort, Hashing, Hashing functions, Collision resolution techniques.	20%	13

*Continuous Evaluation:

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

Reference Books:

1. An Introduction to Data Structures with Applications (TextBook)
    Jean-Paul Tremblay, Paul G. Sorenson; Tata McGraw-Hill; 2nd Edition, (2007)
2. Introduction to Algorithm
    Cormen, Leiserson, Rivest, Stein; PHI (2003); 2nd Edition
3. Data Structures using C and C++
    Tanenbaum; PHI
4. Expert Data Structures with C
    R. B. Patel
5. Theory and Problems of Data Structures
    Seymour Lipschutz; Schaum's Outline Series
6. Data Structures Through C++
    Yashavant Kanetkar; BPB

Course Outcome:

After Learning the course the students shall be able to:

1. describe the significance of various linear and non-linear data structures such as arrays, stack, queue, linked list, trees and graph.
2. identify the appropriate data structure for a given problem.
3. construct most suitable data structure to solve a problem by considering various problem characteristics such as data size and various type of operations.
4. design and implement various techniques for searching, sorting and hashing.

List of Practical:

1.   Write a program to perform various stack operations using array

2.   Write a program to convert infix expression to prefix and postfix expression using stack

3.   Write a program to perform insert and remove operations on following

   a. Simple Queue
   b. Circular Queue
   c. Priority Queue

4.   Write a program to perform Double Ended Queue [Input Restricted / Output Restricted]

5.   Write a program to create a singly link list in FIFO & LIFO form

6. **Write a program to perform following singly link list operations**

   a. insert   b. delete

   c. search   d. reverse

7. **Write a program to create a doubly link list in FIFO & LIFO form**

8. **Write a program to perform following doubly link list operations**

   a. insert   b. delete

   c. search   d. reverse

9. **Write a program to add two polynomials**

10. **Write a program to perform following circular link list operations**

    a. insert   b. delete

11. **Write a program to create a binary search tree and print its element in**

    a. Inorder   b. Preorder   c. Postorder

12. **Write a program for insertion of a node in B tree / B+ tree**

13. **Write a program to create a graph in a adjacency list structure traverse it in**

    a. DFS   b. BFS

14. **Write a program to perform following sort**

    a. Bubble Sort   b. Selection Sort

    c. Insertion Sort   d. Shell Sort

    e. Quick Sort   f. Heap Sort

    g. Merge Sort   h. Radix Sort

15. **Write a program to search an element using**

    a. Linear Search   b. Binary Search