Code No.: MDS 502
Course Title:**Data Structures and Algorithms**   Full Marks: 75
Nature: Theory +Practical (Compulsory)   Credit: 3

Course Description:
This course includes the basic foundations in of data structures and algorithms and various data structures like stack, queue, list, tree and graph. Additionally, the course includes idea of sorting and searching.

Learning Objectives:
After successful completion of this course, the student will be able to

- Introduce basic concepts data structures and algorithms, abstract data types, asymptotic notations
- Design and use of data structures such as stack, queue, linked list, tree and graph.

Course Contents:
Unit 1: Introduction to Data Structures & Algorithms   [3 Hrs.]
    Data types, Data structure and Abstract date type
    Dynamic memory allocation
    Introduction to Algorithms
    Asymptotic notations and common functions

Unit 2: Stack   [6 Hrs.]
    Basic Concept of Stack, Stack as an ADT, Stack Operations, Stack Applications
    Conversion from Infix to Postfix Expressions and Evaluation of Postfix Expressions using Stack

Unit 3: Queue   [4 Hrs.]
    Basic Concept of Queue, Queue as an ADT, Primitive Operations in Queue
    Linear Queue, Circular Queue, Priority Queue, Queue Applications

Unit 4: Recursion   [4 Hrs.]
    Principle of Recursion, Comparison between Recursion and Iteration, Tail Recursion

    Factorial, Fibonacci Sequence, GCD, Tower of Hanoi(TOH)

    Applications and Efficiency of Recursion

Unit 5: Lists   [8 Hrs.]
    Basic Concept, List and ADT, Array Implementation of Lists, Linked List
    Types of Linked List: Singly Linked List, Doubly Linked List, Circular Linked List.
    Basic operations in Linked List: Node Creation , Insertion and Deletion from Linked List
    Stack and Queue as Linked List

Unit 6: Sorting   [8Hrs.]
    Introduction and Types of sorting: Internal and External sort
    Comparison Sorting Algorithms: Bubble, Selection and Insertion Sort, Shell Sort
    Divide and Conquer Sorting: Merge, Quick and Heap Sort
    Efficiency of Sorting Algorithms.

Unit 7: Searching and Hashing   [7Hrs.]
Introduction to Searching, Search Algorithms: Sequential Search, Binary Search
Efficiency of Search Algorithms
Hashing : Hash Function and Hash Tables, Collision Resolution Techniques

Unit 8: Trees and Graphs   [8Hrs.]
Concept and Definitions, Basic Operations in Binary Tree, Tree Height, Level and Depth
Binary Search Tree, Insertion, Deletion, Traversals, Search in BST
AVL tree and Balancing algorithm, Applications of Trees
Definition and Representation of Graphs, Graph Traversal, Minimum Spanning Trees:
Kruskal and Prims Algorithm
Shortest Path Algorithms: Dijksrtra Algorithm.

Laboratory Works:
The laboratory work consists of implementing different algorithms and data structures studied in
the course using C programming.

References:
1. Langsam, Y. ,Augenstein, M.J.   &Tanenbaum, A.M. (2015).*Data Structures using C&C++.* , 2nd Edition, Pearson, India.
2. LeenAmmeral.*Programmes and Data Structures in C*, Wiley Professional   Computing.
3. Rowe, G.W. (2016).*Introduction to Data Structure and Algroithms with C and C++* , prentice Hall India.
4. Kruse, R.L., Leung, B.P. &Tondo, C.L.(2013).*Data Structure and Program Design in C*, 2nd Edition, Pearson Education , New Delhi, India.

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