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Department: Mathematics and Computer Science
Course Title: Data Structures and Algorithms

COURSE OBJECTIVES:
The course should enable the students to:
- Learn the basic techniques of data structures
- Application of data structures
- Learn the basic techniques of algorithm analysis.
- Demonstrate several searching and sorting algorithms.
- Implement linear and non-linear data structures.
- Demonstrate various tree and graph traversal algorithms.
- Analyze and choose appropriate data structure to solve problems in real world.

Unit 1: Data structures
Students must learn the basic concepts of the following data structures:

- Arrays

- Multidimensional Arrays

- Assertions

- Containers

- Stacks

- Collections

UNIT 2: SEARCHING AND SORTING
Basic concepts: Introduction to data structures, classification of data structures, operations on data structures, abstract data type, algorithms, different approaches to design an algorithm, recursive algorithms; Searching techniques: Linear search, binary search and Fibonacci search; Sorting techniques: Bubble sort, selection sort, insertion sort, quick sort, merge sort, and comparison of sorting algorithms.

UNIT 2: LINEAR DATA STRUCTURES
Stacks: Primitive operations, implementation of stacks using Arrays, applications of stacks arithmetic expression conversion and evaluation; Queues: Primitive operations; Implementation of queues using Array, applications of linear queue, circular queue and double ended queue (DEQUE).

UNIT 3: LINKED LISTS
Linked lists: Introduction, singly linked list, representation of a linked list in memory, operations on a Single linked list; Applications of linked lists: Polynomial representation and sparse matrix manipulation.

Types of linked lists: Circular linked lists, doubly linked lists; Linked list representation and operations of Stack, linked list representation and operations of queue.

UNIT 4: NON LINEAR DATA STRUCTURES

Trees : Basic concept, binary tree, binary tree representation, array and linked representations, binary tree traversal, binary search tree, tree variants, application of trees; Graphs: Basic concept, graph terminology, graph implementation, graph traversals, Application of graphs, Priority Queue.

LIST OF REFERENCE BOOKS:

1. Y Daniel Liang, "Introduction to Programming using Python", Pearson.
2. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers,2017.
3. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley Student Edition.