IT214: DATA STRUCTURES & FILES

Credit and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	3	4	1	8	5
Marks	100	100	-	200	

A. Objective of the Course:

This course will introduce some of the fundamental concepts in Computer Science like how data is represented and manipulated in computer systems in the form of linear and nonlinear manner.

The main objective to give the course is:

- To teach the students how to select and design data structures and algorithms, how Data structure stores data in a computer efficiently.
- This course offers the students a mixture of theoretical knowledge and applicability of data structures in real life.
- To Strengthen the ability to identify and apply the suitable data structure for the given real world problem.

B. Outline of the Course:

Sr. No.	Title of the unit	Minimum number of hours
1.	Introduction to Pointer and Memory Allocation	02
2.	Introduction to Data Structure	02
3.	Linear Data Structure	15
4.	Non Linear Data Structure	15
5.	Searching and Sorting	09
6.	Hashing and File Structure	02

Total hours (Theory): 45

Total hours (Lab): 60

Total hours: 105

C. Detailed Syllabus:

1. **Introduction To Pointer And Memory Allocation** **02 hours** **4%**

   Pointer to structure, Pointer with functions

   Dynamic Memory Allocation : malloc(), calloc(), realloc(), free()

2. **Introduction To Data Structure** **02hours** **4%**

   - Introduction to Data, Information, Data Type,Different types of Data Type : Built-In and Abstract Data Type, Introduction to Algorithm, Program
   - Introduction to Data Structure,Needs for Data Structure, Different types of Data Structure

3. **Linear Data Structure** **15 hours** **33%**

   - **Array**

     Notations : one dimension, two dimension and multi dimension, Memory Representation of Array : Row Order and Column Order, Concept of Sparse Matrices
   - **Stack**

     Memory Representation of Stack, Operations : push, pop, peep, changeApplications of Stack: Recursion : Recursive Function Tracing, Tower of Hanoi, Conversion : Infix to Postfix, Evaluation: Prefix and Postfixexpression
   - **Queue**

     Memory Representation of queue, Simple Queue : Insert and Deleteoperation, Circular Queue : Insert and Delete operation, Concepts of: Priority Queue, Double-ended Queue, Applications of Queue : Process Scheduling, Resource Sharing, Traffic control at a turning point
   - **LinkedList**

     Memory Representation of LL, Singly Linked List : Insert at First, Insert at End, Insert accordingto Sorted order, Delete node, Doubly Linked List : Insert and Delete operation, Concept of Circular Linked List, Applications of Link List : Memory Management, Sparse Matrix Manipulation, Polynomial Representation

4. **Non Linear Data Structure** **15 hours** **33%**

   - **Tree**

     Tree Concepts (Tree, Binary, Full Binary, Complete Binary), Memory Representation of Tree (Linked Representation, Sequential Representation, Threaded Representation), Tree Traversal Techniques: Pre-order, Post-order and In-order (Recursive algorithm), Binary Search Tree : (Insert ,Search and Delete Operations with all options.), General Tree to Binary Tree Conversion

     B Tree, 2-3 Tree : Insert and Delete Operation, Heap Tree, Height-Balance Tree(AVL Tree) : Insert and Delete Operations, Applications of Tree : Manipulation of Arithmetic Expression, Decision Tree, Hierarchical Tree, Directory Structure of File system

- **Graph**
  Graph concepts (undirected graph, directed graph, simple graph, multi graph , weighted graph, null graph, mixed graph, cycle, path, elementary path, forest, Degree, sub graph, connected graph), Memory Representation of Graph (Adjacency Matrix, Adjacency List, Set representation), Breath First Search &Depth First Search, Applications of Graph: Shortest Path : Dijkstra's algorithm, Minimum Spanning Tree : Kruskal's & Prim's algorithm

5. **Searching and Sorting** 09 hours 20%
   - Searching: Sequential Search ,Binary Search : Iterative and Recursive
   - Sorting: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Radix Sort, Heap Sort
6. **Hashing and File Structure** **02 hours** **4%**
   - Importance of Hashing, Collision-Resolution Techniques: rehashing and chaining,Different Hashing Functions:Division, Mid-square, Folding, Length-dependent, Digit Analysis, Multiplicative, Applications of Hashing
   - Introduction to File Structure, Concepts, record, Sequential, Indexed and Random file organization

D. Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Faculty would use coached problem solving method as it is class format in which faculty provide a structured, guided context for students working collaboratively to solve problems.
- Attendance is compulsory in lectures and laboratory which carries 5% component of the overall evaluation.
- Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation.
- Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weight age of 5%.
- Surprise tests/Quizzes will be conducted which carries 5% component of the overall evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Minimum 10 experiments are suggested in the laboratory related to course content.

E. Student Learning Outcome:

Upon completion of this course, students will be able to do the following:

- Students will able to select and use appropriate data structures that efficiently address program requirements.
- Students will be able to identify and implement the algorithm, (basic operations) for manipulating each type of data structure.
- Student will be able to synthesize efficient algorithms in common engineering design situations.

F. Recommended Study Material:

Text Books:

1. An Introduction to Data Structures with Applications, Jean-Paul Tremblay, Paul G. Sorenson, McGraw-hill.

Reference Books:

1. Classic Data structures, D.Samanta, Prentice-Hall International.
2. Data Structures using C & C++, Ten Baum, Prentice-Hall International.
3. Data Structures Using C, Oxford Higher Education, Reema Thareja
4. Data Structures: A Pseudo-code approach with C, Gilberg & Forouzan, Thomson Learning.
5. Fundamentals of Data Structures in C++, Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, W. H. Freeman.
6. Data Structure through C (A Practical Approach) , Dhanpat Rai & Co., G. S. Baluja

Web Materials:

1. http://www.itl.nist.gov/div897/sqg/dads
2. http://www.leda-tutorial.org/en/official/ch02s02s03.html
3. http://www.leda-tutorial.org/en/official/ch02s02s03.html
4. http://www.softpanorama.org/Algorithms/sorting.shtml