

**Summer Term - 2022**

**CS F211 (Data Structures and Algorithms)**

# Course Handout Part II

**Date:28th May 2022**

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

**Course No.** : CS F211

## **Course Title** : Data Structures & Algorithms

## **Instructor-in-Charge** : Sameera Muhamed Salam

**Scope and Objective of the Course:**

The main objective of this course is to introduce structures for storing data and algorithms for retrieving/manipulating data. It incorporates techniques for designing such structures. The course covers design, implementation and applications of data structures including linked lists, stacks, queues, heaps, hash tables, balanced binary search trees, and graphs. This course also introduces mathematical and experimental techniques for analyzing the complexity of algorithms. The course discusses sorting and searching algorithms with detailed analysis on complexity of algorithms. The course introduces algorithm design techniques like Divide and Conquer, Greedy, Dynamic Programming to solve various interesting problems.

At the end of the course the student should be able to

* Understand Asymptotic notation and apply the same to analyze algorithms.
* Understanding of basic data structures with the complete analysis and implementation details.
* Understanding of sorting and searching algorithms.
* Understanding of basic algorithmic techniques.
* Apply appropriate data structure and algorithms to solve problems.

**Textbooks:**

**T1.** Cormen TH, Leiserson CE, Rivest RL, and C Stein. **Introduction to Algorithms.** MIT Press Second Edition (India reprint: Prentice-Hall 2009).

**Reference books**

**R1.** Micheal T Goodrich and Roberto Tamassia. **Algorithm Design: Foundations, Analysis and Internet examples.** (John Wiley &Sons, Inc., 2002).

**R2.** Jon Kleinberg and Eva Tardos. **Algorithm Design.** Pearson Education. (2007).

**R3.** Sanjoy Das Gupta, Christos Papadimitriou, Umesh Vazirani, **Algorithms.** Tata McGraw- Hill Publishers.

**Course Plan:**

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| --- | --- | --- | --- |
| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| 1-2 | To introduce data structures and algorithms | Course Introduction & Motivation. | T1-1 |
| 3 - 6 | To understand analysis of algorithms | Growth of Functions & Asymptotic Notation,  Simple Case Studies: Binary search & Bubble Sort | T1-2,3,4  R1-1 |
| 7-8 | To understand Divide and Conquer Algorithmic Technique | Divide & Conquer, Merge Sort & Quick Sort (Analysing lower bounds) | T1-7  R2 – 5 |
| 9-10 | To understand Linear time sorting algorithms | Linear time Sorting Algorithms – Radix Sort and Bucket Sort (Analysing lower bounds) | T1 – 2, 6, 8  R1- 4 |
| 11 – 16 | To understand basic datastructures, their implementations, Complexity, Efficiency & Applications | Linked Lists, Types of Linked Lists, Stack ADT, Queue ADT, Double ended Queue , Vectors, Lists & Sequences | T1-10  R1-2 |
| 17-18 | To understand Tree Data Structure | Tree ADT, Binary Tree, Types of Binary tree, | R1 - 2 |
| 19 - 22 | To understand  Advanced data  structures like  Priority queues,  Heaps, Hash  tables, Maps, Skip  lists, Dictionaries,  Search Trees. | Priority Queue ADT, Heaps, Applications of heap: Insertion Sort, Selection Sort & Heap Sort |  |
| 23 - 24 | MAP ADT, Dictionories and Hash Tables, Separate Chaining vs. Open Addressing, Probing, Rehashing. | T1 – 11  R1- 2 |
| 25 - 30 | Binary Search Tree, Balanced Binary SearchTrees - Red-Black Trees, Skip list (Implementation, Complexity & Efficiency) | T1 – 12, 13  R1- 3 |
| 31 - 36 | To understand String Manipulation and Dynamic Programming Algorithmic Technique | Trie Data Structure, Pattern Matching Algorithms, LCS using Dynamic Programming | T1 – 4,15, 32  R1- 9 |
| 37 - 38 | To understand Graph Data Structure and Greedy Algorithmic technique | Graphs ADT& Graph Algorithms: Representation schemes, Traversals: DFS and BFS | T1 – 22,  R1 - 6 |
| 39 - 42 | Greedy Algorithms: Shortest path and MST (Dijkstra, Kruskal, and Prim-Jarnik algorithms.) | T1- 23, 24  R3 – 4,5 |

**Evaluation Scheme:**

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| --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Mid Test | 90 minutes | 25% | 24/6 3.30 -5.00 PM | Closed Book |
| Lab – Continuous Evaluation & Final Test | Every assignment will be evaluated.  Final lab examination will be of one hour | 35% (Assignments by Continuous Evaluation (25%) &  Final Lab Test (10%)) | To be declared | Open Book |
| Open Book |
| Comprehensive | 3 hours | 40% | 23/07 FN | Closed Book |

**Note:** minimum 40% of the evaluation to be completed by midsem grading.

**Chamber Consultation Hour:** Monday (5 PM to 6 PM) Room No: H107

**Notices:** All notices pertaining to this course will be displayed on the CS & IS Notice Board.

**Make-up Policy:** Prior Permission is mustand make-up shall be granted only in genuine cases.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**INSTRUCTOR-IN-CHARGE**

**CS F211**