Winter 2021-2022

1. Course Code: **IT205**

2. Title: **Data Structures**

3. Instructors: **Dr. Priyanak Singh** and **Dr. V. Sunitha**

4. Credit Structure (L-T-P-Cr): **3-0-0-3**

5. Associated Lab Course: **IT206/Data Structures Lab using OOP/0-0-4-2. Note that the lab will run as an independent course by a different CI.**

6. Slot: **Semester II** (BTech-I)

7. Category: **Core**

8. Prerequisites:
   - **Discrete Mathematics**
   - **Programming**

9. Foundation for: **CS/IT stream of courses**

10. Abstract Content:
The course aims to introduce the concept of data structures, and their indispensability in implementing algorithms and also how they aid in improving performance. An extensive coverage of the well-known and important data structures and routines/algorithms associated with them will be covered. Basic algorithms as well as some more advanced ones demonstrating the use of data structures are covered. The course will also cover the analysis of the performance of data structures and algorithms, in terms of the time and space resources they consume.

11. Suggested textbook:
'Data Structures and Algorithms', by Aho, Hopcroft and Ullman, Addison-Wesley, 1999.
Reference books:
'Data Structures and Algorithms in C++/Java', by Goodrich, Tamassia, and Goldberg, Wiley 2011
'Introduction to Algorithms', by Cormen, Leiserson, Rivest, and Stein, PHI, 2010

12. Grading policy:
Grading will be on the basis of absolute performance, and NO a-priori distribution into slots for relative grading. Exact numbers will be specified in due course. You are required to attend at least 75 % of the lectures of the course; failure to do so will result in a reduction of two grades from the grade you earn by your performance. For example, if you get a grade of BC and attend less than 75 % of the lectures you will be awarded a revised grade of CD.

13. Evaluation Scheme: (Tentative)

Component	Syllabus	Date	Weightage
Mid-sem exam	Topics covered during 28/03/2022 to 15/05/2022	As per Mid-sem Examination Time Table (16/05/2022-21/05/2022)	33%
End-sem exam	Topics covered during 22/05/2022 to 10/07/2022	As per End Semester Examination Time Table (11/07/2021-16/07/2021)	33%
Others	Quiz based on topics covered during classes	No specific dates but shall run throughout the semester with intimation or without	34%

14. Course Content:

Topic	Detailed Content
Preliminaries	Representation of data on a computer, data types & array and linked list representations, ways of representing programs and associated data on computers
Analysis tools	Notion of the running time of an algorithm, Recurrences, Parameters of performance
Dictionary operations	Find, Max, Min, Successor, Predecessor (query operations); Insert, Delete (modify operations)
List data	Stacks, queues, variants implementation using arrays and linked lists, hashing
Sorting	Comparison based sorting algorithms, Other sorting algorithms, lower bounds for comparison-based sorting algorithms, Best-case, worst-case and average-case running times. Quicksort, Heap Sort, insertion sort, bubble sort etc.
Order Statistics	Maximum and minimum elements of a set, Finding median, searching for an element of a given rank, finding the rank of a given element, ranks of a subset of elements, Maintaining rank information for a dynamic set
Trees	Heaps, Binary search trees (BST), height of BST, Tries
Balanced BSTs	Red Black trees, AVL Trees, 2,3,4-trees, B Trees
Graphs	Representation using adjacency matrices and adjacency lists, Graph searching algorithms BFS and DFS