22AIE203	DATA STRUCTURES & ALGORITHMS 2	L-T-P-C: 2- 0- 3- 3

Course Objectives

- This course helps students to implement and understand space and time optimizing structures and learn their behaviours
- This course helps students to comprehend multidimensionality in memory structures
- This course helps students to understand the geometric organization of data
- This course provides an overview of space-building and immutability in functional data structure
- This course gives an introduction to graphical structures and use them in solving problems

Course Outcomes

After completing this course, the students will be able to

CO1: Design suitable data structures for problem-solving.
CO2: Use appropriate data structures for problem-solving scenarios.
CO3: Apply the interoperability of data structures to solve problems.
CO4: Visualize multidimensional geometry of data structure and concurrency.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	3	1	-	-	-	3	3	-	3	3	3	-
CO2	2	1	2	3	1	-	-	-	3	3	-	3	3	2	-
CO3	2	1	2	3	1	-	-	-	3	3	-	3	3	3	-
CO4	1	-	-	1	3	-	-	-	3	3	-	3	-	1	-

Syllabus

Unit 1

Graphs- Representations of graphs, Adjacency and Incidence matrices, Adjacency List, Dynamic Graphs and persistence - Sparse Matrices- Key Value and Structural implementations, Scalability and data driven parallelism, Block and band matrices. Generalized Matrix and Vector interface. Standard implementations in Numpy (Python) and NDArray (Java) - Temporal manipulation and persistence

Unit 2

Functional data structures, ConsList, immutable Set, Immutable Maps, Sorting immutable linear structures (functional sort). Map and Reduce Operations on Sequences

Unit 3

Retroactive structures and operations – Geometric structures- Point location and sweeping, Orthogonal Range searches and fractional cascading in 2D and 3D. -Higher data structures - Tries and inverted Tries- Radix Sort, Higher Hash functions, SHA256, Chaining of Hash Lists (Blockchain) and change detection, Merkel trees- Distributed bitwise representations and Fusion trees - large string structures (Google and DNA problems)

Textbooks/References

Mehlhorn, Kurt, Peter Sanders, and Peter Sanders. Algorithms and data structures: The basic toolbox. Vol. 55. Berlin: Springer, 2008.

Bhim P Upadhyaya, Data Structures and Algorithms with Scala. Springer International Publishing, 2019.

Aho, Alfred V. "Data Structures and Algorithms, Addison-Wesley." Reading, Mass. (1983).

Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. 2009. Introduction to Algorithms, Third Edition (3rd ed.). The MIT Press

Evaluation Plan

Assessment	Internal/External	Weightage (%)
Assignments (Minimum 2)	Internal	30
Quizzes (Minimum 2)	Internal	20
Mid-Term Examination	Internal	20
Term Project/ End Semester Examination	External	30