



**Birla Institute of Technology & Science, Pilani**  
Hyderabad Campus

## SECOND SEMESTER 2023-2024

### Course Handout Part II

Date: 09-01-2024

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	: Venkatakrishnan Ramaswamy ( <a href="mailto:venkat@hyderabad.bits-pilani.ac.in">venkat@hyderabad.bits-pilani.ac.in</a> )
Instructors	: NLBhanu Murthy, Barsha Mitra, Paresh Saxena, S Shashank Attarde Pranjali Devidas

### Scope and Objective of the Course:

Data Structures & Algorithms is a foundational course in Computer Science. It pertains to the design of efficient logical structures to store, access & manipulate data and the to design of efficient algorithms to solve computational problems. The course starts with defining precise notions of measuring efficiency of algorithms. The course covers design, implementation and analysis of data structures such as linked lists, stacks, queues, heaps, binary search trees and graphs. It discusses sorting and search techniques, with detailed performance analysis. Additionally, the course covers algorithm design techniques such as Divide-and Conquer, Greedy Algorithms and Dynamic Programming, with applications to computational problems.

The objectives of the course are for the student to be able to

- Understand asymptotic time complexity and analyze algorithms using this formalism.
- Understand basic data structures with performance analysis and cultivate the ability to write correct and efficient implementations.
- Understand basic searching and sorting techniques.
- Understand basic algorithmic design techniques and acquire the ability to apply these techniques to design correct and efficient algorithms to pertinent problems.
- Understand rudimentary notions of time complexity lower bounds, especially in relation to search and sorting problems.

### Textbook:

**T1.** T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein. *Introduction to Algorithms*, MIT Press(Indian reprint: Prentice Hall of India), 3rd Edition, 2009.



## Reference books

**R1.** M.T. Goodrich and R. Tamassia, *Algorithm Design: Foundations, Analysis and Internet examples*, John Wiley & Sons, 2006.

**R2.** J. Kleinberg and E. Tardos, *Algorithm Design*. Pearson Education, 2013.

**R3.** S. Dasgupta, C. Papadimitriou, U. Vazirani, *Algorithms*, McGraw-Hill (Indian edition), 2017.

## Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-2	Introducing the importance of data structures & algorithms	Course introduction.	1
3-4	Introduce asymptotic notation formalism for analyzing performance of algorithms	Growth of functions	3
5-12	Understand standard sorting techniques with performance analysis	Sorting algorithms: Insertion sort, Bubble sort, Quick sort, Merge sort, Radix sort and Bucket sort. Lower bounds on complexity of comparison-based sorting algorithms.	2, 7, 8
13-15	Understand standard selection techniques with performance analysis	Selection algorithms. Linear-time selection algorithm via median of medians	9
16-25	Understand elementary data structures	Elementary Data Structures: Stacks, Queues, Linked lists, Priority queues, Heaps, Heapsort	10, 6
26-27	Understand hash tables	Hash tables	11
28-30	Understand binary search techniques and techniques to balance them	Binary search trees, balancing binary search trees, Red-Black Trees, Skip lists	12, 13
31-37	To understand standard algorithm design techniques and acquire the ability to correctly apply them to problems.	Algorithm design techniques: Divide and conquer, Greedy algorithms, Dynamic Programming	4, 15, 16
38	To understand basics of amortized analysis	Amortized analysis	17
39-42	To understand basic graph algorithms and their performance analysis	Graph algorithms: Traversals & their analysis, Shortest Path Algorithms	22, 24, 25



**Evaluation Scheme:**

Component	Duration	Weightage	Date & Time	Nature of Component
Midsemester Test	90 minutes	30%	12/03 - 11.00 - 12.30PM	Closed book
Laboratory Continuous evaluation	Weekly lab assignments will be evaluated.	24%	TBA	Open book (textbook only without annotations)
Final Lab Test	2 Hours	11%	TBA	Closed book.
Comprehensive Examination	180 minutes	35%	09/05 FN	Closed book

\*40% of the Evaluation will be completed by Mid Semester Grading.

**Chamber Consultation Hour:** To be announced in class.

**Notices:** Will be posted online on the CMS course management system. Students are expected to subscribe for email notifications from CMS that they would need to check several times a day. Students are responsible for keeping up with announcements, some of which may be made in detail only in class.

**Make-up Policy:**

No make-ups will be offered for the Laboratory continuous evaluation; we will take the best n-k lab scores, for n and k that will be announced.

For the Mid-semester test and Comprehensive exam, no make-ups will be offered, except in case of medical or family emergencies of a severe nature or other unavoidable extenuating circumstances, as judged by the Instructor-in-Charge, for which prior permission must be sought, where feasible. Documented evidence (e.g. a Doctor's letter) will be necessary before consideration of such a request and must reach the I/C prior to the commencement of the exam.

**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**

