ESO207 First Course Handout
(2024-25-I Semester)

- **Title** ESO 207: Data Structures And Algorithms

- **Instructor**

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	(Please mention [ESO 207] in the subject line.)

- **Meeting times**

Class:	Monday, Wednesday, Friday 10 – 10:50 AM at **L17**, LHC
Tutorial/Discussion:	some Saturdays 10 – 10:50 AM
	(I'll confirm with the location, LHC/CSE, each week by email)
Office hour:	Monday through Saturday 9:30 AM – 12 PM
	(except the class times)

  There will be no guided labs. However, programming assignments and a coding test will be there.

- **Tutors** There are 8 tutors assigned for this course. Each of them will hold a discussion hour each week. These tutors are experts in algorithms and they are there to help you. So, feel free to email them or go to their discussion hours as mentioned in the table below. Note that KD is the Kadim Diwan building in the CSE Department which houses a lab in the bottommost (1-st) floor. There are also some empty spaces for discussions outside the KD102 room in the 1-st floor. RM is the Rajeev Motwani building in the CSE Department, right behind the KD building, which has some empty spaces for discussions in the 4-th and 5-th floors. For any online meetings, just click on the link within the specified time period.

Name	Email	Time	Place
Abhijeet Agarwal	abhijeeta21@iitk.ac.in	Wed 3-4 PM	KD 1-st floor lab
Anuj Singhal	anuj@cse.iitk.ac.in	Wed 2-3 PM	RM 5-th floor
Geetika	geetika@cse.iitk.ac.in	Fri 6-7 PM	Outside KD 102
Krutuparna Paranjape	krutuparna21@iitk.ac.in	Thu 6-7 PM	KD 1-st floor lab
Sajja Eswara Sai Raghava	esraghava@cse.iitk.ac.in	Tue 4-5 PM	https://meet.google.com/agh-wicp-vim
Shantanu Kolte	shantanu@cse.iitk.ac.in	Thu 12-1 PM	KD 1-st floor lab
Sandeep Nitharwal	nsandeep21@iitk.ac.in	Wed 2-3 PM	RM 4-th floor
Pratham Sahu	spratham21@iitk.ac.in	Wed 2-3 PM	KD 1-st floor lab

- **Syllabus**

  - Algorithms, pseudocode, and complexity.

  - Algorithm with numbers

- – Divide and conquer paradigm
- – Graph algorithms and data structures
- – Greedy and dynamic programming paradigm
- – Additional topics

- **Resources**

  Lectures will be delivered using the blackboard/writing pad. Students are encouraged to take detailed lecture notes. No particular textbook will be thoroughly followed. As a reference, you may look at the following two books.

  - – Dasgupta, Sanjoy, Christos H. Papadimitriou, and Umesh Virkumar Vazirani. Algorithms. McGraw-Hill Higher Education, 2008.
  - – Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. Introduction to algorithms. MIT press, 2022.

- **Evaluation criteria**

Coding Assignments	7%
Theory Assignments	0%
Quizzes (2)	18%
Coding test	30%
Midsem	20%
Endsem	25%
Attendance	10%

  Slight ($\pm 5\%$) deviations in the above are possible.

- **Tentative lecture schedule** The course lectures will be roughly divided into the following 7 modules.

  1. Preliminaries: FCH. Historical context of algorithms. programs, algorithms, and pseudocode – illustration with a simple example. Fibonacci series – recursive and iterative algorithms. Informal time complexity analysis. Formal Complexity Notations. (3 lectures)
  2. Algorithm with numbers: Algorithms for addition, multiplication, subtraction, division – and their complexity analyses. Algorithms for modular arithmetic. GCD and extended Euclid's algorithm. (5 lectures)
  3. Divide and conquer algorithm: Mergesort. Binary search in a sorted array. Faster multiplication. Master theorem. Median finding. (5 lectures)
  4. Graph algorithms and data structures: Graphs. Adjacency lists and matrices. Data structures. Detour: arrays and lists. Supported operations and complexities for each data structures. Depth First Search (recursive and iterative). Detour: Stacks. Breadth First Search. Detour: Queues. Single source shortest paths. Detour: binary (min) heaps. (12 lectures)
  5. Greedy and Dynamic Programming: Minimum spanning tree. String algorithms such as edit distance. (5 lectures)
  6. Additional topics Calculator with stacks. Binary search trees. AVL Trees. Puzzles. Advanced contemporary algorithms (if time permits). (9 lectures)

- **Course Policies**

  1. Coding: A strong C coding ability is essential to do well in the course. There will be coding assignments and a coding test that will constitute a large portion of your final score in this course. Therefore, you may want to brush up your knowledge from ESC 111/112 courses. You will need a computer for the coding assignments in this course. It may be a good time to get a laptop if you don't have one. Otherwise, you may want to check with the computer center or other computing labs in the institute.

2. <u>Attendance:</u> Attending the lectures is compulsory in this course. If you attend the lectures carefully, you'll have to study less. We will take bio-metric attendance with the following policy. You are permitted to miss a maximum of 2 lectures during the course without any penalty and without any genuine reason. If you miss between 3 and 5 lectures, you will be awarded 5/10 marks in attendance. If you miss 6 or more lectures, you will be awarded 0 in attendance. If you miss more than 2 lectures, then you must show a valid proof of absence (such as a medical certificate, travel tickets, etc). Whether your reason is genuine or not is solely upon the discretion of the instructor. Habitual absentees could be de-registered from the course. You must be settled in the classroom before 10:00 AM. Nobody will be allowed to enter the class after 10:03 AM as it distracts everyone in a large class as this.

3. <u>Plagiarism:</u> Any unethical behavior in any components of the course if caught, may result in a straight failing grade in the course and reporting to the senate. Let us all take this seriously. You are allowed to consult the coding problems with anyone or the web. However, you may not copy from them. We have very good software available to catch any such cheating behavior.

4. <u>Communication:</u> We will use the helloIITK platform: https://hello.iitk.ac.in/ to manage the course. Announcements, assignments, scores, attendance records, etc will all be posted there. Some announcements may also be conveyed via the course mailing list. Please make sure you check helloIITK and your webmail regularly. You will also need to register on *Gradescope* for the coding assignments. Please add yourself to https://www.gradescope.com/ using the entry code "XGVZNB". Make sure to use your '@iitk.ac.in' email address to register for this course in Gradescope. Make yourself comfortable with both helloIITK and Gradescope as soon as possible. Further instructions on the coding assignments will be communicated later.

5. <u>Exams:</u> You should make yourself available on Mondays and Wednesdays 2-5 PM throughout the course as per the schedule given by DoAA. There will be two quizzes on August 28, Wednesday, 2-5 PM and October 30, Wednesday, 2-5 PM. The programming test will be on October 16, Wednesday, 2-5 PM. The dates may change subject to room/lab availability but they will surely be on Mondays/Wednesdays between 2-5 PM. There will be NO makeup quizzes/exams unless under extreme circumstances, which is solely upon the discretion of the instructor. In the written exams, it is not enough to know the answer. You must be able to write it technically. In other words, clarity and legibility of your solutions are as important as the solution itself.

Take it easy,
Don't sit too long in front of a computer,
Otherwise, you'll go crazy!