## MTH 210a: Statistical Computing (2022-2023 - II)

---


INSTRUCTOR

Dootika Vats
580 Faculty Building

*E-mail:* dootika@iitk.ac.in
*Web:* https://dvats.github.io/


COURSE DESCRIPTION

This course covers the theoretical and practical components of various topics in Statistical computing. To be clear, the course is not on coding computational algorithms, rather on learning about why a computational algorithm works, and where it is used. Having said that, being able to implement a statistical algorithm will be a key component of the course.

Topics in the course include:

- Generating discrete and continuous random variables
- Monte Carlo and importance sampling
- Gradient-based optimization methods
- Non-gradient-based optimization methods
- Stochastic optimization methods
- Least squares and penalized regression
- Expectation-Maximization algorithm
- Cross-validation
- Bootstrap
- Bayesian computation

ATTENDANCE

Attendance is not compulsory. As you can see, we will cover many topics in this course, and thus it will be a fast-paced course. If you miss any class, you will find yourself fall behind. I highly recommend you make it a priority to attend all classes. Paying attention in class will make it much easier to do well in class.

PREREQUISITES

MSO205a (or equivalent), MTH208a. Due to limited lab space, the course is only open to students taking the course as a DC.

LECTURES AND LABS

The course has 3 lectures and 1 lab. Theoretical methodological discussions will take place during lectures. During lab, code for various concepts will be shared with you and problems will be given to you. We will be using `R` for code implementations.

Mon: 10am - 11am *(lab)*
Mon: 2pm - 3pm
Tue: 2pm - 3pm
Web: 2pm - 3pm

QUIZZES, ASSIGNMENTS, MARKS

- There will be roughly 4 (surprise) quizzes, held during lecture hours. The lowest quiz mark will be dropped.
- There will be roughly 4 (announced) coding assignments held during lab.
- Mid-sem and end-sem exams will be held in the lecture hall complex, and will not be a coding-based exam. However, as always, I may ask some coding related questions in these exams.

| | |
|---|---|
| Quizzes | 20% |
| Coding Assignments | 20% |
| Mid-sem Exam | 30% |
| Final Exam | 30% |

**Academic Honesty**

Academic integrity is essential to a positive teaching and learning environment. All students enrolled in the course are expected to complete coursework responsibilities with fairness and honesty. Failure to do so by seeking unfair advantage over others or misrepresenting someone elses work as your own, can result in disciplinary action.

> *Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic grades, honors, awards, or professional endorsement; or altering, forging, or misusing a University academic record; or fabricating or falsifying of data, research procedures, or data analysis.*

**References**

There will be no one particular book. The following will be useful references.

- "Simulation" by Sheldon M. Ross (Academic Press, Fourth Edition), 2006, Chaps. 1-5.
- "Non-Uniform Random Variable Generation" by Luc Devroye. [Online book available]
- "Statistical Inference" by Casella and Berger.
- "Elements of Statistical Learning" by Hastie, Tibshirani, and Friedman
- "Convex Optimization" by Boyd and Vandenberghe
- "An Introduction to the Bootstrap" By Efron
- "Monte Carlo Statistical Methods" by Casella and Robert