

MATH 6112-A. FALL 2026.

Advanced Linear Algebra.

Luca Dieci

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Important Disclaimer. This syllabus reflects the state of things at the time of its writing. In case Georgia Tech will provide directions to modify the instructional mode due to external factors, some of the mechanics of the course will need to be modified. Thank you for your understanding.

Who	When	Where	E-mail
Teacher: Luca Dieci	MW 12:30–1:45	Skiles 314	dieci@math.gatech.edu
Office Hours	W 2:30-4:00 or by app.t	Skiles 215	remote on demand

Course description and objectives. This is a proof-based, rigorous course on advanced Linear Algebra, intended for beginning MS and PhD students in all programs in which the School of Mathematics participates. The main **objective** is to provide you with some tools which will be useful in your later studies.

Prerequisites. Some prior knowledge of Linear Algebra (at the level of our Math 3406 or 4305) is expected, as it is some prior basic knowledge of Abstract Algebra and Analysis at the senior undergraduate level.

Book. There is no required textbook for the class. I will distribute Lecture Notes to students enrolled in the class, and we will follow these notes quite closely. To prepare the Lectures Notes, I have used several sources, but especially the books listed below. You **do not need to buy** any of these books, though all of them are quite good in several respects and the textbook(s) by Horn & Johnson you may want to have.

Matrix Analysis, R. Horn & C. Johnson. *Topics in Matrix Analysis*, R. Horn & C. Johnson. *Linear Algebra and its Applications*, P. Lax.

Lectures Plan

We will cover most of (1)-(5) below, more material will be part of the homework assignments.

(1) Linear transformation, matrices, similarity. Minimal and characteristic polynomials. Eigenvalues. Diagonalization and Jordan form over a general field. (2) Inner product, Schur form. Spectral theorem for normal matrices. Quadratic forms and Hermitian matrices, projections and best approximation. Positive definiteness, congruence, and inertia. (3) Positive matrices. Perron-Frobenius theory. Stochastic matrices. (4) Singular value decomposition, generalized inverse. Variational characterizations, eigenvalues and singular values inequalities. (5) Matrices depending on parameters. Eigenvalues and eigenvectors under perturbation.

- We will use **Canvas** for communications, posting and uploading homework sets, lecture notes, etc..
- It is important that you will be **able to upload** all homework sets by the required deadlines, as a **pdf** file.

Grading

- Grading will be based on **4 Homework Sets**, **2 Midterm Exams**, and the **Final Exam**. Each homework set will count 10% of your grade, each midterm exam will count 15% and the Final will count 30%.
- There will be **NO** make-up Exam, except under documented medical problem or professional development (job interview, conference presentation), or Georgia Tech official activity.
- Grading scheme will be as follows.
A: [85, 100], B: [70, 85), C: [50, 70). Letter grades scheme will be as follows: A: [85, ...], B: [75, 85), C: [60, 75), D:[50,60]. F:(..., 50).

Exams

- Homework will be due by midnight of the due date: you will not be able to upload your homework after midnight.
- The Midterm Exams will occur during regular class periods, and to solve these you can use your own notes, past homework assignments, and the lecture notes, but no access to the internet or extra books.
- There will be **NO** make-up Exam, except under documented medical problem or proven professional development (job interview, conference presentation), or Georgia Tech official activity.

Homework, office hours and extra help

- Your homework will be graded both for mathematical precision and for clarity of exposition. If the grader or I cannot understand your argument, then it will be marked down. Solutions to the homework problems must be **typed** in 10pt font or larger.
- Submission as a pdf file is required. Due dates are enforced.
- Please seek advice quickly if you cannot solve a problem: Use the office hours, and ask for an appointment at other times.
- For communication on changes, assigned homework, and other relevant class information, always refer to the class link on **Canvas**.

HWs and Exams dates.	
Given To You	Due Back
Sep 9 (W)	Sep 16 (W)
Oct 7 (W)	Oct 14 (W)
Oct 28 (W)	Nov 4 (W)
Nov 16 (M)	Nov 23 (M)
Sep 23 (W)	Exam 1
Nov 11 (W)	Exam 2
TBD	Final Exam

Honor Code. All students at Georgia Tech are expected to adhere to the Academic Honor Code. See

<https://policylibrary.gatech.edu/student-life/academic-honor-code>

In particular, you will not attempt to cheat, collaborate, or use unauthorized sources during Exams, and you will work on your own for Homework assignments. Transgressors will receive a grade of 0 and will be reported to the Office of Student Integrity.

Inclusivity. I am committed to creating a learning environment in which all of my students feel safe and included. I depend on your feedback to make the classroom an environment in which every student feels valued and can engage actively in learning. I will appreciate hearing from you about things I can stop, start, and continue doing, to achieve these goals.

Attendance: Attendance is not required, but very strongly encouraged as there is a drastic difference in the exam performance between students who regularly attend class and those who don't.

Accommodations for Students with Disabilities: If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.