MATH 391: Numerical Linear Algebra
Fall 2025 Course Syllabus

NJIT Academic Integrity Code: Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: NJIT Academic Integrity Code.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu

COURSE INFORMATION

Course Description: This course provides an introduction to computational linear algebra. Topics include direct solution of linear systems, iterative methods for linear systems, fast Fourier transforms, least squares problems, singular value decomposition and eigenvalue/eigenvector problems. The goal of this course is to use linear algebra for understanding data, statistics, deep learning, image processing, AI., etc.. We will occasionally make modest use of some probability; while not required, it is important to be comfortable with such concepts - just basic and informal.

Number of Credits: 3

Prerequisites: MATH 337 with a grade of C or better and CS 113 with a grade of C or better or CS 115 with a grade of C or better or CS 101 with a grade of C or better or CS 100 with a grade of C or better.

Course-Section and Instructors:

Course-Section	Instructor
Math 391-001	Professor S. Afkhami

Office Hours for All Math Instructors: Fall 2025 Office Hours and Emails

Required Textbook:

Title	*Linear Algebra and Learning from Data*
Author	Strang

Publisher	Wellesley Cambridge Press
ISBN #	9780692196380

Recommended Textbooks:

1- Numerical Linear Algebra by Lloyd N. Trefethen and David Bau, SIAM 978-1-61197-715-8

2- Introduction to Applied Linear Algebra – Vectors, Matrices, and Least Squares by Stephen Boyd and Lieven Vandenberghe, Cambridge University Press, 978-1316518960

3- Practical Linear Algebra for Data Science: From Core Concepts to Applications Using Python by Mike Cohen, O'Reilly Media, 978-1098120610

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, November 10, 2025**. It will be strictly enforced.

POLICIES

DMS Course Policies: All DMS students must familiarize themselves with, and adhere to, the Department of Mathematical Sciences Course Policies, in addition to official university-wide policies. DMS takes these policies very seriously and enforces them strictly.

Grading Policy: The final grade in this course will be determined as follows:

Homework/Projects	50%
Midterm Exam	20%
Final Exam	30%

Your final letter grade will be based on the following tentative curve.

A	90 - 100	**C**	65 - 74
B+	85 - 89	**D**	55 - 64
B	80 - 84	**F**	0 - 54
C+	75 - 79		

Attendance Policy: Attendance at all classes will be recorded and is **mandatory**. Please make sure you read and fully understand the Math Department's Attendance Policy. This policy will be strictly enforced.

Homework/Project/Quiz Policy: There will be regular homework assignments from the text and computing assignments.

Exams: There will be one midterm exam held in class during the semester and one comprehensive final exam.

Midterm Exam	Week 7
Final Exam Period	December 14 - December 20, 2025

The final exam will test your knowledge of all the course material taught in the entire course. Make sure you read and fully understand the Math Department's Examination Policy. This policy will be strictly enforced.

Makeup Exam Policy: There will be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event an exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed.

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times.

Generative AI: Student use of artificial intelligence (AI) tools is permitted in this course but you must indicate where and how you have used these tools. Additionally, if and when students use AI in this course, the AI must be cited as is shown within the NJIT Library AI citation page for AI. If you have any questions or concerns about AI technology use in this class, please reach out to your instructor prior to submitting any assignments. Note that students are ultimately responsible for developing skills in the course content area and therefore assignments that have errors and incorrect results will be graded accordingly regardless of whether or not AI tools are used. If you use AI in your coursework, you are encouraged to attempt to understand generated materials.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Fall 2025 Hours)

Further Assistance: For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for Instructor Office Hours and Emails.

Accommodation of Disabilities: The Office of Accessibility Resources and Services (OARS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you need an accommodation due to a disability, please contact the Office of Accessibility Resources and Services at oars@njit.edu, or visit Kupfrian Hall 201 to discuss your specific needs. A Letter of Accommodation Eligibility from the office authorizing student accommodations is required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Office of Accessibility Resources and Services (OARS) website at:

https://www.njit.edu/accessibility/

Important Dates (See: Fall 2025 Academic Calendar, Registrar)

Date	Day	Event
September 1, 2025	Monday	Labor Day
September 2, 2025	Tuesday	First Day of Classes

September 8, 2025	Monday	Last Day to Add/Drop Classes
November 10, 2025	Monday	Last Day to Withdraw
November 25, 2025	Tuesday	Thursday Classes Meet
November 26, 2025	Wednesday	Friday Classes Meet
November 27 to November 30, 2025	Thursday to Sunday	Thanksgiving Recess - Closed
December 11, 2025	Thursday	Last Day of Classes
December 12, 2025	Friday	Reading Day 1
December 13, 2025	Saturday	Saturday Classes Meet
December 14 to December 20, 2025	Sunday to Saturday	Final Exam Period

Course Outline

Week	Topic
1	*Linear Algebra Review*
2	*Numerical Methods for Solving Linear Systems, Gaussian Elimination, LU Factorization*
3	*Iterative Methods for Large Matrices*
4	*Computing Eigenvalues and Eigenvectors*
5	*QR and Least Squares*
6	*Review and Midterm*
7	*Matrix Operations (for Machine Learning)*
8 - 9	*Eigendecomposition, SVD, Principal Component Analysis (PCA)*
10 - 11	*Optimization and (Stochastic) Gradient Descent*
12 - 13	*Learning from Data; Artificial Neuron*

13 - 14	*Clustering, Distance Matrices, Covariance Matrices*