MATH 630: Linear Algebra and Applications
Fall 2023 Course Syllabus

NJIT Academic Integrity Code: All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

COURSE INFORMATION

Course Description: (This course is not intended for students in the Master's in Applied Mathematics program or in the doctoral program in Mathematical Sciences.) Development of the concepts needed to study applications of linear algebra and matrix theory to science and engineering. Topics include linear systems of equations, matrix algebra, orthogonality, eigenvalues and eigenvectors, diagonalization, and matrix decompositions.

Number of Credits: 3

Prerequisites: MATH 211 or MATH 213, and MATH 222

Course-Section and Instructors:

Course-Section	Instructor
Math 630-101	Professor E. Ammicht

Office Hours for All Math Instructors: Fall 2023 Office Hours and Emails

Required Textbook:

Title	Linear Algebra and Learning from Data
Author	Gilbert Strang
Edition	First Edition (January 2019)
Publisher	Wellesley-Cambridge Press
ISBN #	978-06921963-8-0

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, November 13, 2023**. It will be strictly enforced.

COURSE GOALS

Course Objectives: Linear algebra concepts are key for understanding and creating machine learning algorithms, especially as applied to deep learning and neural networks. This course reviews linear algebra with applications to probability, statistics and optimization.

Course Outcomes: Students will gain a thorough understanding of the concepts and ideas of linear algebra, resulting in the ability to formulate problems and apply appropriate algorithms to their solution.

Course Assessment: There are homework assignments, quizzes and a midterm exam held in class during the semester. The final exam will consist of an in class presentation of a final project.

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 and Quizzes	40%
Midterm Exam	30%
Final Project	30%

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

A	86-100	**C+**	64-69
B+	80-85	**C**	50-63
B	70-79	**F**	0-49

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.

Homework: Students are expected to *solve each problem from every section covered*. Study groups are strongly encouraged.

Exams: There will be regularly scheduled quizzes and one midterm exam during the semester and a presentation of a final project during the last class and the final exam week:

Midterm Exam	October 17, 2023
Final Exam Period	December 17 - December 23, 2023

Exams and quizzes 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.

ADDITIONAL RESOURCES

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 2023 Academic Calendar, Registrar)

Date	Day	Event
September 4, 2023	Monday	Labor Day
September 5, 2023	Tuesday	First Day of Classes
September 11, 2023	Monday	Last Day to Add/Drop Classes
November 13, 2023	Monday	Last Day to Withdraw
November 21, 2023	Tuesday	Thursday Classes Meet
November 22, 2023	Wednesday	Friday Classes Meet
November 23 to November 26, 2023	Thursday and Saturday	Thanksgiving Recess - Closed
December 13, 2023	Wednesday	Last Day of Classes
December 14, 2023	Thursday	Reading Day 1
December 15, 2023	Friday	Reading Day 2
December 17 to December 23, 2023	Sunday to Saturday	Final Exam Period

Course Outline

Lecture #	Date	Section #	Subject Topics
1	Sep 5	1.1,1.2,1.3	*Vector and Matrix Operations, the Four Fundamental Subspaces*
2	Sep 12	1.4	*Gaussian Elimination, Gauss-Jordan Elimination, Inverses*
3	Sep 19	Class Notes	*Vector Spaces*
3	Sep 23	1.5	*Orthogonal Matrices, Givens Rotations, Householder Reflections*
4	Oct 3	Class Notes	*Normal Equations*
5	Oct 10	Class Notes	*QR Decomposition*
7	Oct 17		*MIDTERM EXAM*
7	Oct 17	Class Notes	*Determinants*
8	Oct 24	1.6, 1.7	*Eigenvalues, Eigenvectors, Positive Definite and Semidefinite Matrices*
9	Oct 31	1.8, 1.9	*Singular Value Decomposition, Eckart-Young Theorem*
10	Nov 7	1.10, 1.11	*Rayleigh Coefficients, Vector and Matrix Norms*
11	Nov 14	2.1, 2.2, 2.3	*Numerical Techniques*
12	Nov 28	2.4	*Randomized Matrix Multiplication and Applications*
13	Dec 5		*Final Project Presentations*
14	Dec 12		*Final Project Presentations*