MATH 630: Linear Algebra and Applications
Spring 2024 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 630-102	Professor E. Ammicht

Office Hours for All Math Instructors: Spring 2024 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, April 1, 2024**. 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 applying 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	March 5, 2024
Final Exam Period	May 3 - May 9, 2024

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 are in need of accommodations due to a disability please If you need an accommodation due to a disability please contact the Office of Accessibility Resources and Services at oars@njit.edu. The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Office of Accessibility Resources and Services office authorizing your accommodations will be 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:Spring 2024 Academic Calendar, Registrar)

Date	Day	Event
January 16, 2024	Tuesday	First Day of Classes
January 22, 2024	Monday	Last Day to Add/Drop Classes
March 10, 2024	Sunday	Spring Recess Begins
March 16, 2024	Saturday	Spring Recess Ends
March 29, 2024	Friday	Good Friday - No Classes
April 1, 2024	Monday	Last Day to Withdraw
April 30, 2024	Tuesday	Friday Classes Meet
April 30, 2024	Tuesday	Last Day of Classes
May 1, 2024	Wednesday	Reading Day 1
May 2, 2024	Thursday	Reading Day 2
May 3 - May 9, 2024	Friday to Thursday	Final Exam Period

Course Outline

Lecture #	Date	Section #	Subject Topics
1	Jan 22	1.1,1.2,1.3	*Vector and Matrix Operations, the Four Fundamental Subspaces*
2	Jan 29	1.4	*Gaussian Elimination, Gauss-Jordan Elimination, Inverses*
3	Feb 5	Class Notes	*Vector Spaces*
3	Feb 12	1.5	*Orthogonal Matrices, Givens Rotations, Householder Reflections*
4	Feb 19	Class Notes	*Normal Equations*
5	Feb 26	Class Notes	*QR Decomposition*
7	Mar 5		*MIDTERM EXAM*
7	Mar 5	Class Notes	*Determinants*
8	Mar 19	1.6, 1.7	*Eigenvalues, Eigenvectors, Positive Definite and Semidefinite Matrices*
9	Mar 26	1.8, 1.9	*Singular Value Decomposition, Eckart-Young Theorem*
10	Apr 2	1.10, 1.11	*Rayleigh Coefficients, Vector and Matrix Norms*
11	Apr 9	2.1, 2.2, 2.3	*Numerical Techniques*
12	Apr 16	2.4	*Randomized Matrix Multiplication and Applications*
13	Apr 23	4.4	*Optimization*
14	Apr 30		*Final Project Presentations*
15	May 6		*Final Project Presentations*

Updated by Professor E. Ammicht -12/20/2023
Department of Mathematical Sciences Course Syllabus, Spring 2024