MATH 337 Honors: Linear Algebra - Honors
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: Matrices, determinants, systems of linear equations, vector spaces, linear transformations, eigenvalues, eigenvectors, and related topics. Similar to Math 337 but with more emphasis on rigor and proof.

Number of Credits: 3

Prerequisites: MATH 112 with a grade of C or better or MATH 133 with a grade of C or better.

Course-Section and Instructors:

Course-Section	Instructor
Math 337-H02	Professor T. Askham

Office Hours for All Math Instructors: Spring 2024 Office Hours and Emails

Required Textbook:

Title	*Linear Algebra Done Wrong*
Author	Sergei Treil
Edition	September 4, 2017
Publisher	Sergei Treil
Link	https://www.math.brown.edu/streil/papers/LADW/LADW.html

Supplementary Textbook:

Title	*A First Course in Linear Algebra*
Author	K. Kuttler and I. Farah
Edition	Version 2021 A
Publisher	Lyryx Learning Inc
Link	Available in Canvas

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:

The course seeks to develop

- understanding of the fundamental concepts of linear structure that support theoretical, applied and computational analysis including $\mathbf{R}^n$ and $\mathbf{C}^n$, linear combination, span, linear independence, basis and dimension, Euclidean structure, matrices and linear transformations, invertibility, rank, null space, column space, and determinant,
- understanding of the fundamental algorithms of elementary linear algebra, Gaussian elimination and the Gram-Schmidt process, including proficiency in implementation both with pen and paper and by computer program,
- the ability to use linear theory to analyze problems common in applications including systems of linear equations, detection linear dependence relations, LU factorization, eigenvalue problems, orthogonalization, QR factorization, least squares solutions, and the singular value decomposition,
- basic proficiency, both with pen and paper and by computer program, with the use of the fundamental algorithms of elementary linear algebra for the solution of common problems including those listed above,
- the capacity to apply linear algebra through treatment of applications such as balancing chemical equations and computer graphics.
- Familiarity with the axiomatic treatment of linear algebra, including methods of proof.

Course Outcomes:

Students will be able to

- understand and utilize the basic concepts, algorithms and problems of linear algebra to analyze basic applied problems,

- Prove basic facts from definitions and axioms, work with technical definitions and theorems
- Implement basic solutions to problems of applied linear algebra both by hand and computer program (MATLAB),
- apply their understanding of linear algebra in appropriately formulated applications.

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	15%
MATLAB Assignments	15%
Midterm Exams	20% (x2)
Final Cumulative Exam	30%

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

A	90 - 100	**C**	70 - 74
B+	85 - 89	**D**	60 - 69
B	80 - 84	**F**	0 - 59
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: Homework will be distributed and collected on Canvas approximately weekly, with exercises from LADW and other sources.

MATLAB Projects: Students are expected to complete the MATLAB onramp. There will be 2 or 3 medium scale MATLAB projects.

Exams: There will be two exams during the semester and a cumulative final exam during the final exam week:

Midterm Exams	Feb 21, 2024. 4:15-5:45 pm April 10, 2024. 4:15-5:45 pm
Final Exam Period	May 3 - May 9, 2024

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.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Spring 2024 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 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

Week	Sections	Topics
1	1.1-1.2	Vector space definitions, linear combos, bases
2	1.3-1.6	Matrix algebra
3	1.6-1.8	Inverses, subspaces, computer graphics
4	2.1-2.3	Row reduction and analysis of pivots
5	2.4-2.6	General solution of a linear system and the concept of dimension
6	handout	Stoppage Time and LU with pivoting (MIDTERM I on Wednesday Feb 21, 2024)
7	2.7-2.8	Fundamental subspaces, representation formulas
8	3.1-3.5	Determinant concept and definition, properties
		Spring break
9	4.1-4.2	Eigenvalues
10	5.1-5.2	Introduction to inner poduct spaces
11	5.3-5.4	Gram Schmidt algorithm and least squares problems
12	5.5-5.6, 6.1	Adjoints, fundamental subspaces revisited, unitary operators, Schur decomposition
13		Stoppage Time (MIDTERM II on Wednesday April 10, 2024)
14	6.2-6.3	Spectral theorem for normal operators, singular value decomposition
15	6.4, 7.1-7.2	Applications of singular value decomposition, diagonalizing quadratic forms

Updated by Professor T. Askham - 1/11/2023
Department of Mathematical Sciences Course Syllabus, Spring 2024