MATH 337: Linear Algebra
Fall 2021 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.

DMS Online Exam Policy Fall 2021: In the event it is determined that DMS will conduct Common Exams online during Fall 2021, those exams will be administered in Canvas with proctoring using both Respondus LockDown Browser+Monitor on a computer (PC or Mac only; iPad and Chromebooks are not currently supported) and Webex on a phone or secondary device.

Please be sure you read and fully understand our DMS Online Exam Policy.

COURSE INFORMATION

Course Description: Matrices, determinants, systems of linear equations, vector spaces, linear transformations, eigenvalues, eigenvectors, and related topics.

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 337-001	Professor A. Oza
Math 337-005	Professor J. Luke
Math 337-007	Professor J. Ro
Math 337-009	Professor E. Ammicht
Math 337-101	Professor J. Ro

Office Hours for All Math Instructors: Fall 2021 Office Hours and Emails

Required Textbook:

Title	*Linear Algebra and its Applications*
Author	Lay
Edition	5th
Publisher	Pearson
ISBN #	978-0321982384

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Wednesday, November 10, 2021**. 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 R^n and 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 analysis of quadratic forms,
- 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.

Course Outcomes:

Students will be able to

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

Quizzes	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.

Quizzes: Weekly quizzes will focus on a collection of fundamental computations that are foundational for the course. The intention of the quizzes is to provide students an opportunity to master these crucial computations on which much of the course depends.

MATLAB Projects: Weekly MATLAB projects will cover the implementation and use of basic algorithms in linear algebra. The coding of the algorithms is not only a tool of application but also a pathway for understanding. Common exams will feature problems requiring proficiency with MATLAB implementation of basic algorithms.

Homework: Homework problems are assigned for each lecture. These assignments are the broadest preparation for exams—especially the theoretical aspects of the subject. These are not collected or graded; instructors, however, will assume that students have completed these assignments in subsequent lectures. Students having difficulties solving problems in these assignments are encouraged to get help as soon as possible to remain ready to learn new material as it is presented.

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

Midterm Exam I	Wednesday, October 6, 2021
Midterm Exam II	Wednesday, November 10, 2021
Final Exam Period	December 15 - 21, 2021

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: Fall 2021 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 contact Scott Janz, Associate Director of Disability Support Services at 973-596-5417 or via email at scott.p.janz@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/studentsuccess/accessibility/

Important Dates (See: Fall 2021 Academic Calendar, Registrar)

Date	Day	Event
September 1, 2021	Wednesday	First Day of Classes
September 4, 2021	Saturday	Saturday Classes Begin
September 6, 2021	Monday	Labor Day
September 8, 2021	Wednesday	Monday Classes Meet
September 8, 2021	Wednesday	Last Day to Add/Drop Classes
November 10, 2021	Wednesday	Last Day to Withdraw
November 25 to November 28, 2021	Thursday to Sunday	Thanksgiving Recess - Closed
December 10, 2021	Friday	Last Day of Classes
December 13 and December 14, 2021	Monday and Tuesday	Reading Days
December 15 to December 21, 2021	Wednesday to Tuesday	Final Exam Period

Course Outline

Lecture #	Section #	Subject Topic and Homework (HW) Assignment
1	1.1	*Linear Systems* *#2, 4, 10, 15, 18, 24, 29-32*
2	1.2	*Row Reduction and Row Echelon Forms* *#2, 4, 8-11, 13, 18, 20*
3	M1 & M2	*Implementation of the Gauss-Jordan algorithm* *All exercises in the write-ups*
4	1.3	*Vector Equations* *#2, 5, 9, 11, 13, 17, 24*
5	1.4	*Matrix Equations* *#2, 4, 5 ,9, 17, 31*
6	1.5 &1.6	*Solution Sets of Linear Systems & Balancing Chemical Equations* *1.5:#1, 4, 6, 8, 11, 15, 23* *1.6:#7, 9*
7	1.7	*Linear Independence* *#1, 4, 6, 7, 14, 16, 31*
		Common Exam I – Wednesday, October 6
8	1.8	*Linear Transformations* *#2, 4, 7, 9, 13, 15, 22*
9	1.9	*The Matrix of a Linear Transformation* *#5, 7, 10, 15, 18, 20, 23, 25*
10	2.1	*Matrix Operations* *#4, 7, 9, 16, 23*
11	2.2	*Inverse Matrix* *#4, 7, 16, 23, 33*
12	2.3	*Invertibility* *#2, 6, 9, 11, 13, 14, 23, 41*
13	2.5	*Matrix Factorizations* *#2, 4, 5, 8, 11, 15, 17*
14	2.7 & supplement	*Computer Graphics* *#1-10*
15	2.8	*Fundamental Subspaces of a Matrix* *#1, 5, 18-20, 23-27*
16	2.9	*Dimension and Rank* *#5, 9, 10, 11, 12, 17, 18*
		Common Exam II – Wednesday, November 10
17	3.1 & 3.2	*Determinants* *3.1: #3, 4, 18, 19-22, 25-30* *3.2: #1, 4, 6, 9, 21, 22, 25, 26, 27, 28*

18	3.3	*Cramer's Rule* *#2, 5, 8, 11, 16*
19	5.1 & 5.2	*The Eigenvalue Problem* *5.1: #3, 7, 9, 13, 15, 17, 20* *5.2: #4, 7, 9, 13, 15, 16, 20, 21*
20	5.3	*Diagonalization* *#2, 4, 6, 7, 8, 12, 17, 21*
21	5.5	*Complex Eigenvalues* *#4, 5, 13, 14*
22	6.1 & 6.2	*Length and Angles and Orthogonal Sets* *6.1: #1, 8, 10, 12, 14, 15, 16, 20* *6.2: #1, 4, 8, 12, 16, 17, 20, 23*
23	6.3 & 6.4	*Orthogonal Projection and the* Gram-Schmidt *t Process* *6.3: #2, 4, 6, 8, 10, 12, 14, 16*
24	6.5	*Least-Squares Solutions* *#1, 5, 17, 18*
25	7.1 & 7.2	*Symmetric Matrices and Quadratic Forms* *7.1: #1-10, 14, 17, 22, 26* *7.2: #2, 5, 7, 10, 13, 21*