

MATH 337: Linear Algebra *Spring 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: 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 -002	Professor J. Luke
Math 337-004	Professor C. Frederick
Math 337-006	Professor J. Luke
Math 337-008	Professor J. Ratnaswamy
Math 337-102	Professor J. Porus

Office Hours for All Math Instructors: [Spring 2023 Office Hours and Emails](#)

Required Textbook:

Title	<i>A First Course in Linear Algebra</i>
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 3, 2023**. 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 primarily in \mathbf{R}^n but also in \mathbf{C}^n , linear combination, span, linear independence, basis and dimension, Euclidean structure, matrices and linear transformations, invertibility, rank, fundamental, 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, including spectral theory, to analyze problems common in applications including systems of linear equations, detection linear dependence relations, LU factorization, diagonalization, 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,
- mastery of the basic elements of two fundamental problems of linear algebra, solving linear systems and diagonalizing matrices, from both a theoretical and computational perspective.
- 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 and methods of linear algebra to analyze basic applied problems,
- solve linear equations of equations and find eigenvalues and eigenvectors to enable diagonalization,
- 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:

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.

Common Quizzes: Online quizzes, given on a roughly weekly basis, will focus on a collection of fourteen fundamental computations that are foundational for the course. The intention of the quizzes is to provide students an opportunity to begin mastery of these crucial computations on which much of the course depends. Instructors may supplement the common quizzes with quizzes specifically for their sections.

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 & Study Quizzes: Homework assignments are provided to assist students to develop their understanding and skills with linear algebra. These assignments are neither collected or graded. Students should develop and use judgment as to which exercises are needed for them to develop adequate understanding of the material. The standing advice, particularly at the beginning of the course, is that it is better to do too much than too little. Students are urged to seek assistance with problems and exercises with which they have struggled unsuccessfully. Study quizzes are online assignments that, though graded automatically, do not contribute to the final grade. It is recommended that students take the study quiz associated with a lecture before the next lecture to check that they have a robust understanding of the earlier lecture.

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

Midterm Exam I	February 22, 2023
Midterm Exam II	April 5, 2023
Final Exam Period	May 5 - May 11, 2023

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 2023 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](tel: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/accessibility/>

Important Dates (See: [Spring 2023 Academic Calendar, Registrar](#))

Date	Day	Event
January 17, 2023	Tuesday	First Day of Classes
January 23, 2023	Monday	Last Day to Add/Drop Classes
March 13, 2023	Monday	Spring Recess Begins
March 18, 2023	Saturday	Spring Recess Ends
April 3, 2023	Monday	Last Day to Withdraw
April 7, 2023	Friday	Good Friday - No Classes
May 2, 2023	Tuesday	Friday Classes Meet
May 2, 2023	Tuesday	Last Day of Classes
May 3 - May 4, 2023	Wednesday and Thursday	Reading Days
May 5 - May 11, 2023	Friday to Thursday	Final Exam Period

Course Outline

The lecture schedule is suggested only and will vary depending on the section instructor's discretion.

Meeting	Topics	Textbook
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1	Linear Systems in 2 and 3 Unknowns and Introduction to MATLAB	pp. 3-13
2	Gaussian Elimination	pp. 14-20
3	Parametric Vector Form	pp. 21-28
4	Uniqueness of RREF and the Associated Homogeneous System; Balancing Chemical Equations	pp. 25-35
5	Matrix Arithmetic & Algebra	pp. 53-70
6	Matrix Inverse	pp. 71-78, 87-90
7	Elementary Matrices, LU and LDU	pp. 79-86, 99-104
8	Determinants I	pp. 107-118
9	Determinants II	pp. 114-125
10	Review for Common Exam I	
11	Concrete Euclidean Spaces	pp. 143-186
12	Spanning, Linear Independence and Basis	pp. 188-196, 197-207
13	Four Fundamental Subspaces	pp. 197-216
14	Orthogonal Bases and the Gram-Schmidt Process	pp. 229-240
15	Orthogonal Projection, Orthogonal Complement, Least-Squares Solutions and Linear Regression	pp. 240-252
16	Linear Transformation I	pp. 265-285
17	Eigenvalues and Eigenvectors	pp. 341-352
18	Diagonalization	pp. 355-364
19	Powers and Power Series	pp. 366-371, 386-390
20	Dynamical Systems	pp. 378-385
21	Review for Common Exam II	
22	Orthogonal Diagonalization and the SVD	pp. 395-411
23	SVD and some Applications	
24	Positive Definite Matrices and the Cholesky Factorization; Rayleigh quotients; Unconstrained Optimization of Functions of Several Variables	pp. 411- 415
25	Linear Transformations II & III	pp. 287-322
26	Classical Applications of the Determinant	pp. 129-138
27	Extensions for Complex Matrices	pp. 323-338

28	Review for Final Exam	
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Updated by Professor J. Luke - 5/8/2023
Department of Mathematical Sciences Course Syllabus, Spring 2023