

MATH 337: Linear Algebra

Spring 2020 Coordinated 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 337-004	Professor K. Carfora
Math 337-008	Professor P. Milojevic
Math 337-010	Professor Y. Boubendir
Math 337-014	Professor P. Petropoulos
Math 337-018	Professor P. Milojevic
Math 337-030	Professor C. Frederick
Math 337-102	Professor E. Ammicht

Office Hours for All Math Instructors: [Spring 2020 Office Hours and Emails](#)

Required Textbook:

Title	<i>Linear Algebra and its Applications</i>
Author	Lay
Edition	5th
Publisher	Pearson
ISBN #	978-0321982384

University-wide Withdrawal Date: The last day to withdraw with a W is **Monday, April 6, 2020**. It will be

strictly enforced.

COURSE GOALS

Course Objectives

- Learn about matrices, determinants, applications to solving linear system of equations, matrix factorization, eigenvalues and eigenvectors, Gram-Schmidt process.
- Cover relevant applications in economics, science and engineering to illustrate the utility of learning these topics.
- Use mathematical software, in problem solving, to allow the solution of more complex problems and provide visualization of the same.

Course Outcomes

- Prepare students for further study in theoretical courses such as differential and difference equations and least squares analyses.
- To enable students to use linear algebra use for numerical solvability of many problems.
- Students are prepared for applying linear algebra to many practical applications in fields like economics, computer science, physics, engineering, archeology, demography, relativity, etc.

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 and Projects	25%
Common Midterm Exam I	20%
Common Midterm Exam II	20%
Final Exam	35%

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

A	90 - 100	C	60 - 69
B+	85 - 89	D	50 - 59
B	75 - 84	F	0 - 49
C+	70 - 74		

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. Absences from class will inhibit your ability to fully participate in class discussions and problem solving sessions. Tardiness to class is very disruptive to the instructor and students and will not be tolerated. Students might be withdrawn from the class or receive an "F" because of absences.

MATLAB: MATLAB is a mathematical software program that is used throughout the science and engineering curricula. Several MATLAB assignments will be given out. These assignments have been designed to help you learn how to use this software in order to visualize many of the concepts taught in class.

Projects: It is vital that you complete the required assignments by the specified dates.

Quiz Policy: A short quiz based on the homework problems will be given weekly.

Exams: There will be two common midterm exams held during the semester and one comprehensive common final exam. Exams are held on the following days:

Common Midterm Exam I	February 26, 2020
Common Midterm Exam II	April 8, 2020
Final Exam Period	May 8 - 14, 2020

The time of the midterm exams is **4:15-5:40 PM** for daytime students and **5:45-7:10 PM** for evening students. 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: To properly report your absence from a midterm or final exam, please review and follow the required steps under the DMS Examination Policy found here:

- http://math.njit.edu/students/policies_exam.php

Cellular Phones: All cellular phones and other electronic devices must be switched off and put away during all class times.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: **Spring 2020 Hours**)

Accommodation of Disabilities: Disability Support Services (DSS) 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 Chantonette Lyles, Associate Director of Disability Support Services at **973-596-5417** or via email at lyles@njit.edu. The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Disability Support 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 Disability Support Services (DSS) website at:

- <https://www.njit.edu/studentssuccess/accessibility/>

Important Dates (See: **Spring 2020 Academic Calendar, Registrar**)

Date	Day	Event
January 21, 2020	T	First Day of Classes
January 31, 2020	F	Last Day to Add/Drop Classes
March 15 - 22, 2020	Su-Su	Spring Recess: No Classes/ University Open
April 6, 2020	M	Last Day to Withdraw
April 10, 2020	F	Good Friday - University Closed
May 5, 2020	T	Friday Classes Meet - Last Day of Classes
May 6 & 7, 2020	W & R	Reading Days
May 8 - 14, 2020	F - R	Final Exam Period

Course Outline

***APPLICATION SECTIONS IN RED**

Week	Subjects	Section and Recommended Exercises
1	Systems of Linear Equations	1.1: 2, 4, 10, 15, 18, 24, 29
	Row Reduction and Echelon Form	1.2: 2, 4, 8, 11, 13, 18, 20
	Vector equations	1.3: 2, 5, 9, 11, 13, 17, 24
2	Matrix Equations	1.4: 2,4,5,9,17
	Solutions of Linear Systems	1.5: 1,4,6,8,11,15,23
3	Application to Chemistry (brief)	1.6: 7,9
	Linear Independence	1.7: 1,4,6,7,14,16,31
	Linear Transformations	1.8: 2,4,7,9,13,15
4	Matrix form of Linear Transformations	1.9: 5,7,10,15,18,22
	Matrix Operations	2.1: 4,7,9,16,23
	Inverse of a Matrix	2.2: 3,6,9,26,29,32
5	Exam Review	
COMMON MIDTERM #1 WEDNESDAY - FEBRUARY 26, 2020		
	Invertible Matrices	2.3: 2,6,9,11,13,14,41
6	LU Factorization	2.5: 2,4,5,8,11,15,17
	Application to Computer Graphics (brief)	2.7: 1,2,5
	Introduction to Determinants	3.1: 3,8,9,12,22,24,25,28
7	Properties of Determinants	3.2: 1,4,6,9,21,22,25,26
	Cramer's Rule	3.3: 2,5,8,11,16
	Vector Spaces and Subspaces	4.1: 8,24,30,38
8	Null Spaces and Columns Spaces	4.2: 2,4,14,20,24
	Linear Maps	4.3: 4,5,10,14,15,21
	Dimension of a Vector space	4.5: 2,4,6,9,13,15,18
9	Rank	4.6: 1,2,5,9,13,17,18
	Application to Markov Chains (Brief)	4.9: 2,4,6, 8,10
10	Eigenvalues and Eigenvectors	5.1: 3,7,9,13,15,17,20
	The Characteristic Equation	5.2: 4,7,9,13,15,16,20,21
11	Exam Review	
COMMON MIDTERM #2 WEDNESDAY - APRIL 8, 2020		
	Diagonalization	5.3: 2,4,6,7,8,12,17,21
	Complex Eigenvalues	5.5: 4,5,13,14
12	Inner Product, Length, and Orthogonality	6.1: 1,8,10,12,14,15,16,20
	Orthogonal Sets	6.2: 1,4,8,12,16,17,20,23
	Orthogonal Projections	6.3: 2,4,6,8,10,12,14,16

13	The Gram-Schmidt Procedure	6.4: 1,4,8,9,12
	Inner Product Spaces	6.7: 1,2,4,6,8
	Diagonalization of Symmetric Matrices	7.1: 1-10,14,17,22,26
14	Quadratic Forms	7.2: 2,5,7,10,13,21
	Exam Review	

MATLAB Projects for M337: Linear Algebra, Spring 2020

Visit the [textbook website](#) for supplementary materials including a guide to getting started with Matlab. For additional help, the math department has Matlab TA's. Click for [locations and times](#) when they are available.

The first thing you need to do is to install the LayData toolbox on the computer where you will be using it. Here are the steps. I will assume that you have Matlab installed or are using Matlab on a campus PC.

- Download the [LayData Toolbox](#).
- Uncompress the file and move the unzipped directory to the location on your computer where you want it.
- Add the toolbox to the Matlab search path. To do this run Matlab, and at the >> prompt, type pathtool to bring up the path management window. Click Add Folder, and select the folder containing the toolbox. Be sure to save it.

Subject	Week Due	Notes
Getting Started with MATLAB	February 3, 2020	Section 14: Some recent versions of Matlab use New -> Script instead of New -> M-file . Do install the Laydata programs and set the path as described in section 16 for next assignment. DO NOT HAND IN.
Practice Row Operations and Reduced Echelon form and ref	February 17, 2020	Note that there are two separate short assignments here.
Lower Triangular Matrices	March 9, 2020	Problem (1c) and (2b) ask you to prove a result about lower triangular matrices. If you have trouble doing this in general, try it first with (2×2) lower triangular matrices, then (3×3) until you see the pattern. For general Matrices, try using the (Σ) notation for the $((i,j))$ entry of a matrix product.
Using backslash to solve $Ax=b$	March 23, 2020	
LU Factorization	April 13, 2020	

*Updated by Professor P. Milojevic - 3/2/2020
Department of Mathematical Sciences Course Syllabus, Spring 2020*
