NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 337: Linear Algebra
Fall 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.

DMS Online Exam Policy Fall 2020: Exams will be proctored using both Respondus LockDown Browser+Monitor and Webex. Students will be required to join a Webex meeting from their phone with their cameras on, and to access the exam through LockDown Browser on a Mac or Windows PC with webcam. Students must follow all instructions related to environment checks and camera positioning.

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 P. Milojevic
Math 337-007	Professor P. Ward
Math 337-009	Professor P. Milojevic
Math 337-017	Professor E. Ammicht
Math 337-029	Professor C. Frederick
Math 337-101	Professor S. Afkhami

Office Hours for All Math Instructors: Fall 2020 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 **Monday, November 9, 2020**. It will be strictly enforced.

SPECIAL NOTE - FALL 2020

- Teaching will be done online using WebEx.
- MatLab assignments should be submitted electronically through Canvas.
- Quizzes will be assigned on Canvas and submitted through Canvas.
- Exams will be done online through Canvas using appropriate technology (i.e. Respondus with Lockdown Browser).

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 will be proctored using both Respondus LockDown+Monitor and Webex. Students will be required to join a Webex meeting from their phone with their cameras on, and to access the exam through LockDown Browser on a Mac or Windows PC with webcam. Students must follow all instructions related to environment checks and camera positioning.

Exams are held on the following days:

Common Midterm Exam I	October 7, 2020
Common Midterm Exam II	November 11, 2020
Final Exam Period	December 15 - 21, 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: Fall 2020 Hours)

Accommodation of Disabilities: The Office of Accessibilty and Servuces (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 Chantonette Lyles, Associate Director of Office of Accessibility Resources and 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 Office of Accessibility Resources and Services 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/studentsuccess/accessibility/

Important Dates (See: Fall 2020 Academic Calendar, Registrar)

Date	Day	Event
September 1, 2020	T	First Day of Classes
September 5, 2020	S	Saturday Classes Begin
September 7, 2020	M	Labor Day
September 8, 2020	T	Monday Classes Meet
September 8, 2020	T	Last Day to Add/Drop Classes
November 9, 2020	M	Last Day to Withdraw
November 25, 2020	W	Friday Classes Meet
November 26-29, 2020	R - Su	Thanksgiving Recess - University Closed
December 10, 2020	R	Last Day of Classes
December 11 & 14, 2020	F & M	Reading Days
December 15 - 21, 2020	T - M	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 - OCTOBER 7, 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 - NOVEMBER 11, 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: 1,4,8,12,16,1720,23
	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, Fall 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	September 17, 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	October 1, 2020	Note that there are two separate short assignments here.
Lower Triangular Matrices	October 22, 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 \(2\times2\) lower triangular matrices, then \(3\times3\) until you see the pattern. For general Matrices, try using the \(\Sigma\) notation for the \((i,j)\) entry of a matrix product.
Using backslash to solve Ax=b	November 5, 2020	
LU Factorization	November 26, 2020	