

## MATH 631: 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.

It is my professional obligation to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating or plagiarizing will be subject to disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at [dos@njit.edu](mailto:dos@njit.edu)

### COURSE INFORMATION

**Course Description:** A graduate-level treatment of linear algebra with emphasis on mathematical rigor and depth of understanding. Topics include linear spaces, duality, matrices, determinants, spectral theory, inner product spaces, and matrix decomposition. Time permitting, numerical aspects of eigenvalue calculations are covered.

**Number of Credits:** 3

**Prerequisites:** MATH 222 and MATH 337, or departmental approval.

**Course-Section and Instructors:**

| Course-Section | Instructor              |
|----------------|-------------------------|
| Math 631-001   | Professor Travis Askham |

**Office Hours for All Math Instructors:** [Fall 2021 Office Hours and Emails](#)

**Required Textbook:**

*There is no required textbook for this course. Please see the recommended texts below:*

- Optional: Linear Algebra and Its Applications by Peter Lax (2nd Ed), Wiley, ISBN 9780471751564
- Optional: Numerical Linear Algebra by L. N. Trefethen and D. Bau (1st Ed) SIAM

**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

- To develop a deeper understanding of linear maps in a finite dimensional setting.
- To gain intuition for core concepts, including: eigenvalues and eigenvectors, singular value decompositions, duality, rank, and determinants.
- To master the basics of linear algebra practice, including: solving a system of equations and applying matrix decompositions

### Course Outcomes

- Students recognize when linear algebra concepts can be applied to a variety of mathematical and engineering problems.
- Students demonstrate the ability to apply numerical methods to solve linear algebra problems with accuracy, precision, and efficiency.
- Students demonstrate greater ability in making and understanding rigorous arguments.

## 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     | 40% |
| Midterm Exam | 30% |
| Final Exam   | 30% |

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

|    |          |    |         |
|----|----------|----|---------|
| A  | 90 - 100 | C+ | 76 - 79 |
| B+ | 86 - 89  | C  | 60 - 75 |
| B  | 80 - 85  | F  | 0 - 59  |

**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.

**Email and Canvas:** Regularly check your NJIT email account and the course information posted on Canvas for class assignments and announcements from your instructor.

**Homework:** Homework problem sets will be assigned regularly by the instructor via canvas and will include problems requiring basic coding in MATLAB or Python. Due dates as posted on canvas; late work is not accepted (rare exceptions may be made if there is good reason). **All HW assignments are to be submitted via the canvas course page (NOT email).**

**Old Qual Problem:** 10% of your homework grade will be based on a problem from a previous qualifying

exam. You must prepare a solution, present the solution in-class, and type a LaTeX version of your solution. The solutions from all students will be compiled and will create a resource for studying for the qualifying exams. The problem to solve and presentation dates will be assigned through Canvas.

**Exams:** As of now, all exams will be administered in person. Midterm exams will be held during a regular class meeting; the location and date of the final will be provided to you when they are set.

|                   |                        |
|-------------------|------------------------|
| Midterm Exam      | October 25, 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<br>November 28, 2021  | Thursday to<br>Sunday   | Thanksgiving Recess - Closed |
| December 10, 2021                    | Friday                  | Last Day of Classes          |
| December 13 and<br>December 14, 2021 | Monday and<br>Tuesday   | Reading Days                 |
| December 15 to<br>December 21, 2021  | Wednesday to<br>Tuesday | Final Exam Period            |

## Course Outline

This class meets MW 10-11:20 AM in Kupfrian Hall 202. The first lecture is September 1<sup>st</sup> and the last lecture is December 8<sup>th</sup>. There is no lecture on September 6<sup>th</sup> (Labor Day).

| Lecture     | Section of Notes    | Topic   |
|-------------|---------------------|---|
| 1 - 5       | 1                   | Linear spaces                                     |
| 6 - 10      | 2-4                 | Matrices, connection to ODES, and the determinant |
| 11-14       | 5                   | Algebraic spectral theory                         |
| 15 (Oct 25) | <b>MIDTERM EXAM</b> | Sections 1-5 of notes.                            |
| 16-18       | 6                   | Inner products and norms                          |
| 19-23       | 7                   | Analytic spectral theory                          |
| 24-28       | 8                   | Matrices in practice                              |
| TBD         | <b>FINAL EXAM</b>   | The final exam period is Dec. 15-21               |

*Updated by Professor T. Askham - 10/5/2021  
Department of Mathematical Sciences Course Syllabus, Fall 2021*