# Syllabus, Fall 2025

MA 631-2E-Linear Algebra
(UH 4002, 2:00 pm-3:15 pm TR)

## Instructor Information:

**Instructor Name:** Dr. Muhammad "Jaman" Mohebujjaman

**Email:** mmohebuj@uab.edu **Office:** UH 4045 **Office Phone:** 205-934-2195
**Office Hours:** TR 12:50 pm-1:50 pm or by appointment.

**Preferred Methods of Contact:** Email is the preferred method of contact if you have questions. Please expect a response within 24 hours on weekdays and a slower response on weekends (or emails received after 5 pm on Friday will be returned on Monday morning). Include the course name and number in the subject line of your email for a faster response.

## Course Material:

**Text:** A set of class notes (evolved from courses taught by several faculty members in the department) will be provided. These notes contain all definitions, theorems, and examples, but no proofs (which will be presented in detail in class).

**Other good books:**

1. S. H. Friedberg, A. J. Insel & L. E. Spence, Linear Algebra, Pearson, 5th Ed.
2. P. Lax, Linear Algebra and Its Applications, Wiley, 2nd Ed.
3. K. Jänich, Linear Algebra, Springer.
4. S. Axler, Linear Algebra Done Right, Springer.

## Course Contents:

Vector spaces; linear transformations and matrices; determinants; systems of linear equations and Gaussian elimination; eigenvalues, eigenvectors and diagonalization; generalized eigenvectors and Jordan decompostion; minimal polynomials, Cayley Hamilton theorem.

## Grading:

The final grade will be a weighted average and will be calculated as below:

**Homework:** 40%, **Mid Term Exam:** 20% (10/16/2025, in-class, tentative), **Final Exam:** 40% (12/09/2025, 1:30 PM-4:00 PM)

## Homework Policy:

Homework will NOT be accepted late. However, one lowest homework grade will be dropped.

## Grading Scale:

A: [90,100]; B: [80,90); C:[70,80); D:[60,70), F:[0,60)

## Make-Up Exams:

There will be NO make-up exams except for the observance of a religious holiday or for an official university absence.

## Exam Policy:

Midterm and Final exams will be closed-book, in-class and comprehensive.

## Preparation for Qualifying Exam:

This course covers the material for linear algebra in the Joint Program Exams. Past exams can be downloaded at `https://www.uab.edu/cas/mathematics/graduate/phd/qualifying-exams-testbank`
Problems from past exams will also be used in homework assignments.

## Student Learning Outcomes:

Upon successful completion of this course, students will be able to:

- Understand the concept of vector space and apply it in different situations.
- Determine if a subset is a subspace using subspace criterion.
- Find a basis of a vector space.
- Change coordinates related to two different bases.
- Know properties of matrix ranks and apply them.
- Use equivalent criteria for independent subspaces.
- Understand the concept of linear transformations and express a linear transformation using a matrix.
- Understand the fundamental theorem of linear algebra and apply it.
- Use isomorphisms to relate an abstract vector space to the $n$-tuple vector space and a linear transformation to a matrix.
- Know the concepts of linear functional and dual space, together with their properties.
- Derive properties of determinants using the definition of determinant.
- Know cofactor expansion, express the inverse of an invertible matrix using its adjoint and determinant, and know Cramer's rule.

- Perform LU decomposition by Gauss elimination and express the elimination process using Gauss matrices.
- Implement Gauss elimination, together with forward and backward substitutions, to solve a system of linear equations.
- Implement Gauss elimination with partial pivoting and use permutation matrices to describe the process.
- Know properties of eigenvalues and eigenvectors of a linear operator, and how its diagonalizability is related to its eigenvalues and eigenvectors.
- Understand the concepts of generalized eigenvectors and generalized eigenspaces, and find a Jordan basis to obtain the Jordan decomposition of a linear operator.
- Understand Cayley-Hamilton Theorem, find the minimum polynomial of a linear operator, and use it to find the Jordan form.

## General Course Policies:

- No cell phones or other electronic devices will be allowed on your person during exams.
- Be respectful of yourself, and others in the course.
- While explaining, you should not talk to anyone in class except me.
- Feel free to ask me any questions in class or outside of class.

## Shared Values Statement:

Collaboration, integrity, respect, and excellence are core values of our institution and affirm what it means to be a UAB community member. A key foundation of UAB is diversity. At UAB, everybody counts every day. UAB is committed to fostering a respectful, accessible, and open campus environment. We value every member of our campus and the richly different perspectives, characteristics, and life experiences that contribute to UAB's unique environment. UAB values and cultivates access, engagement, and opportunity in our research, learning, clinical, and work environments. Our department aims to create an open and welcoming environment and to support the success of all UAB community members.

## Classroom Attendance Rule:

Students are expected to attend all the classes unless they have a valid acceptable excuse.