



East China Normal University
GEC International Summer School

MAT33: Linear Algebra

Term: June 16th to July 18th, 2025

Class Hours: Monday through Friday, 110 minutes each day (2,750 minutes in total)

Instructor: Mu He

Home Institution: Xi'an Jiaotong-Liverpool University

Office Hours: TBD

Email: mu.he@xjtlu.edu.cn

Course Description

This course covers matrix theory and linear algebra, emphasizing topics useful in other disciplines. Linear algebra is a branch of mathematics that studies systems of linear equations and the properties of matrices. The concepts of linear algebra are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics. Include: review of matrix algebra, determinants and systems of linear equations, linear dependence and independence, general vector spaces, orthogonal bases and orthogonal projections and so on.

Prerequisite: MAT 21.

Course Objectives

Upon successful completion of this course, you should be able to:



- Demonstrate understanding of general vector spaces, including concepts of subspace, linear independence of vectors, span, bases, change of bases, and dimension, as well as null, row and column spaces.
- Find the bases for the eigenspaces of a matrix and understand their use in the process of diagonalizing a square matrix.
- Demonstrate understanding of the concepts within general inner product spaces, including distance, orthogonality, orthogonal complement, and orthogonal projections, and apply these concepts to find the least squares polynomial fit to a given set of data points.

Required Text

Introduction to Linear Algebra. 5th ed, by Strang, Gilbert. 2016.

ISBN: 9780980232776

Course Hours

The course has 25 class sessions in total. Each class session is 110 minutes in length, for a total of 2750 minutes of in-class time. The course meets from Monday to Friday. ECNU awards 3 credits for this course. Different universities may count course credits differently. Consult officials at your own home institution.

Attendance

Summer school is very intense and to be successful, students need to attend every class. Occasionally, due to illness or other unavoidable circumstance, a student may need to miss a class. ECNU policy requires a medical certificate to be excused. Any absence may impact on the student's grade. Moreover, ECNU policy is that a student who has more than 3 absences will fail the course. Arriving late or leaving early will count as a partial absence.

Grading Policy

ECNU awards grades of A, A-, B+, B, B-, C+, C, D, and F. Most colleges and universities do not award transfer credit for grades of D or F.



In this course, grading will be based on the following:

Assignments*2	10%*2=20%
Participation	10%
Midterm Exam	30%
Final Exam	40%

General Expectations

Students are expected to:

- Attend all classes and be responsible for all material covered in class and otherwise assigned. Any unexcused absence may impact a student's grade.
- Arrive to class on-time: Late arrivals are disruptive to your fellow students and to the conduct of the class.
- Complete the day's required reading and assignments before class.
- Review the previous day's notes before class; make notes about questions you have about the previous class or the day's reading.
- Refrain from texting, phoning or engaging in computer activities unrelated to class during class (不要用手机). It is highly disrespectful to the professor and to the class.
- Participate in class discussions and complete required written work on time.

Course Schedule

The planned schedule sketched out below may be modified to suit the interests or abilities of the enrolled students or to take advantage of special opportunities or events that may arise during the term.

Week 1

- *Day 1*
 - o *Overview of the course*
- *Day 2*
 - o *Review of matrix algebra*
- *Day 3*



- *Systems of linear equations*
- *Day 4*
 - *Systems of linear equations -continued*
 - *Determinants and their properties*
- *Day 5*
 - *Tutorial/Discussion*

Week 2

- *Day 1*
 - *Row reduction and echelon forms*
- *Day 2*
 - *Matrix operations, including inverses*
- *Day 3*
 - *Block matrices*
- *Day 4*
 - *Linear dependence and independence*
- *Day 5*
 - *Tutorial/ Discussion*
 - *Assignment 1 due*

Week 3

- *Day 1*
 - *Subspaces and bases and dimensions*
- *Day 2*
 - *Orthogonal bases and orthogonal projections*
 - *Orthogonality*
- *Day 3*
 - *Gram-Schmidt process*



- *Linear models and least-squares problems*
- *Day 4*
 - *Midterm Review Session*
 - *Discussion/Tutorial*
- *Day 5*
 - *Midterm*

Week 4

- *Day 1*
 - *Cramer's Rule*
- *Day 2*
 - *Eigenvalues and eigenvectors*
 - *Vector spaces*
- *Day 3*
 - *Diagonalization of a matrix*
- *Day 4*
 - *Symmetric matrices*
- *Day 5*
 - *Tutorial/Discussion*
 - *Assignment 2 due*

Week 5

- *Day 1*
 - *Positive definite matrices*
- *Day 2*
 - *Similar matrices*
 - *Linear transformations*
- *Day 3*



- *Singular Value Decomposition*
- *Day 4*
 - *Final Exam Review Session*
 - *Tutorial/Discussion*
- *Day 5*
 - *Final Exam*

Academic Honesty

Students are expected to maintain high standards of academic honesty. Specifically, unless otherwise directed by the professor, students may not consult other students, books, notes, electronic devices or any other source, on examinations. Failure to abide by this may result in a zero on the examination, or even failure in the course.