East China Normal University
GEC International Summer School

MAT 21: 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
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Course Description

This course focuses on a general introduction to linear algebra and its applications. Topics include basic linear algebra, matrix arithmetic and determinants, vector spaces, inner product spaces, eigenvalues and eigenvectors, linear transformations, symmetric matrices, linear ordinary differential equations (ODE), systems of linear ODE and Fourier series.

Prerequisite: None

Required Text

Lay-Lay-McDonald, Linear Algebra and its Applications (5th edition).

ISBN: 978-0-321-98238-4

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*3	5%*3=15%
Midterm Exam	35%
Final Exam	50%

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*
  - *Course outline*
  - *Geometric foundations: dots, lines and planes, intersection and orthogonality in Euclidean geometry*
- *Day 2*
  - *Systems of linear equations*
  - *Row reduction*
- *Day 3*
  - *Vectors in R^n*
  - *Linear independence*
  - *Matrices*
- *Day 4*
  - *Linear transformations*
  - *Matrix algebra*
- *Day 5*
  - *In-class exercises*

Week 2

- *Day 1*
  - *The inverse of a matrix*
  - *Determinants: properties*
- *Day 2*
  - *Computation by row reduction or cofactor expansion*
- *Day 3*
  - *Geometric interpretation in terms of volume*
  - *Assignment 1 due*
- *Day 4*
  - *Vector spaces and subspaces, including examples of function spaces*
- *Day 5*
  - *In-class exercises*

Week 3

- *Day 1*
  - *Nullspace (kernel) and column space (image) of a matrix (linear transformation)*
- *Day 2*
  - *Bases*
  - *Coordinate systems*
- *Day 3*
  - *Midterm, covering chapters 0-3*
- *Day 4*
  - *Dimension and rank*
  - *Change of basis*
- *Day 5*
  - *In-class exercises*

Week 4

- *Day 1*
  - *Eigenvalues and eigenvectors*
  - *The characteristic equation*
  - *Assignment 2 due*
- *Day 2*
  - *Diagonalization*
  - *Eigenvectors and linear transformations*
- *Day 3*
  - *Complex eigenvalues*
- *Day 4*
  - *The Euclidean inner product on R^n*
  - *Orthogonal sets*
- *Day 5*
  - *In-class exercises*

Week 5

- *Day 1*
  - *Orthogonal projection*
  - *Gram-Schmidt process*
- *Day 2*
  - *Least squares problems*
  - *Applications to linear models*
- *Day 3*

    - *Inner product spaces*
    - *Final review session*
- *Day 4*
    - *Final review session*
- *Day 5*
    - *Final exam*
    - *Assignment 3 due*

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.