South China Normal University International Summer Session

20G45160: Linear Algebra

Term: July 15th –August 9th, 20
Instructor: Dr. Matthew Macauley
Home Institution: Clemson University
Credit: 4

Course Description

This will be a standard Linear Algebra class being offered in an intensive 4-week summer session, so *everything goes quickly*. In terms of content, workload, and difficulty, it will be roughly equivalent to a 15-week 4-credit hour Linear Algebra class at a tier-1 American university. It will be demanding and challenging but worth it, as this is arguably the most important math classes that STEM majors will take.

Course Readings

Officially, I am assigning *Linear Algebra: A free linear algebra textbook and online resource,* by David Cherney, Tom Denton, Rohit Thomas and Andrew Waldron https://www.math.ucdavis.edu/~linear/
However, most linear algebra textbooks should suffice, so feel free to use your favorite if you already have one. Homework problems will not be taken from any textbook.
Calculator: A calculator is not required for this course and will not be allowed on quizzes or exams. You are free to use one for the homework, though.

Grading Scale

Percentage	Grade
90-100	A
80-89	B
70-79	C
60-69	D
＜60	F

Grading

The grades are based on individual homework, quizzes, one midterm, and the final exam. There are four weekly individual homework assignments, which will be assigned near the beginning of week 1 to 4 and due on Monday of the following week. *Get started early because they are long*, as this is an entire semester course condensed into 4 weeks. *No late homework will be accepted*. You are encouraged to discuss the homework and to work together on the problems. However, each student is responsible for the final preparation of his or her own homework, in his or her own words. Homework must be *neatly well written* with work shown and proper exposition for full credit. The exam will consist of short answer questions derived from the lecture material. The final exam will be cumulative. The weights of grading components are as follows:

Homework	25%
Quizzes	**15%**
Midterm	**20%**
Final exam	**40%**

Any student who gets an A or B on the final exam (including + and -) will get at least that grade in the course, provided that they have a passing grade on the homework.

Course Schedule:
Week 1:
- *Monday*: Geometry of linear equations. Elimination with matrices.
- *Tuesday*: Multiplication & inverse matrices. LU-factorization
- *Wednesday*: Vector spaces, column space, row space.
- *Thursday*: Solving Ax=b: pivot & free variables. Homogeneous & particular solns.
- *Friday*: Linear independence, spanning sets, and bases.

Week 2:
- *Monday*: Column space, null space, row space, left null space.
- *Tuesday*: Other vector spaces. Applications to graphs and networks.
- *Wednesday*: Orthogonality. Projections.
- *Thursday*: Least Squares and applications to statistics.
- *Friday*: **MIDTERM**.

Week 3:
- *Monday*: Orthogonal bases, Gram-Schmidt, and QR-factorization.
- *Tuesday*: Determinants.
- *Wednesday*: Applications of determinants. Eigenvalues and eigenvectors.
- *Thursday*: Diagonalization. Markov chains**.**
- *Friday***:** Application to Fourier series. Symmetric matrices.

Week 4:

- *Monday*: Positive definite matrices. Complex-valued matrices
- *Tuesday*: Similar matrices and Jordan canonical form.
- *Wednesday*: Singular value decomposition (SVD). Linear transformations.
- *Thursday*: Change of basis matrices. Left, right, and pseudo-inverses.
- *Friday*: **Final exam.**