UM51A: Linear Algebra

Course Description
Linear Algebra is a one-semester course that covers the fundamental concepts of an introductory undergraduate-level course in linear algebra. Particular emphasis is placed on advanced logical reasoning, integrated problem-solving and proofwriting.

Required Textbook
Linear Algebra: An Introduction (First or Second Edition)
Richard Bronson and Gabriel B. Costa
Elsevier Academic Press

Recommended Supplemental Textbooks:
Linear Algebra Done Right,
Sheldon Axler

Linear Algebra and Its Applications,
David C. Lay

Course Topics
- Matrices and Linear Systems
- Matrix operations; Special matrices; Linear systems of equations; The inverse matrix; LU-decompositions of matrices, properties of real vector spaces
- Vector Spaces
  Vectors; Subspaces; Linear independence; Basis and Dimension; Row space; Column space; Rank; Rank-Nullity Theorem
- Linear Transformations
  Functions; Linear transformations; Matrix representations; Change of basis; Properties of linear transformations; Kernel and image
- Determinants
  Computation and properties of determinants; Minors and cofactors; Expansion by minors; Geometry and determinants; Products, inverses, transposes, and determinants
- Eigenvectors and Eigenvalues
  Definitions and examples of eigenvectors and eigenvalues; Computational methods for finding eigenvectors and eigenvalues; Properties of eigenvectors and eigenvalues; Diagonalization of matrices
- Applications of Linear Algebra
Overview of Assignments

Each semester, the letter grade in the course will be determined based on performance on the following types of assignments.

• **In class participation:** Students are expected to participate in in-class discussion sections, and are expected to have a functioning graphics tablet for presenting problems and asking questions during discussion sections. Students will contribute to and be part of an active learning environment.

• **Homework assignments:** Students will complete regular homework assignments (written and/or electronic) to demonstrate their mastery and knowledge of the material covered in each week’s lectures and discussion sections.

• **Unit exams:** Students will complete written exams designed to test depth of understanding of multivariable calculus concepts and the ability to integrate knowledge of course concepts to solve problems and write proofs. There will be approximately 2-3 such exams per semester.

• **Final exam:** There will be a comprehensive, proctored final exam each semester. The final exam will include material covered in lecture, discussion, homework assignments, and exams.