

Math 2121 Linear Algebra – Fall 2023

1. Instructors

Eric Marberg (emarberg@ust.hk)

2. Teaching Assistants

T1A, T1B: LONG Wenpei (wlongab@connect.ust.hk)

T1C, T2A: WANG Bingxin (bwangbo@connect.ust.hk)

T2B, T2C: FU Xiaowen (xfuak@connect.ust.hk)

3. Class Time and Venue

Lectures:

(L1) Tuesdays and Thursdays 16:30 - 17:50 in LTC

(L2) Tuesdays and Thursdays 09:00 - 10:20 in LTD

4. Exclusion(s): MATH 2111, MATH 2131, MATH 2350

5. Prerequisite(s): A passing grade in AL Pure Mathematics / AL Applied Mathematics; OR MATH 1014 OR MATH 1018 OR MATH 1020 OR MATH 1024

6. Topics: Solving linear systems, vector spaces, matrices, linear mappings and matrix forms, inner products, orthogonality and Gram-Schmidt process, eigenvalues and eigenvectors, symmetric matrices and diagonalization, determinants.

7. Intended Learning Outcomes

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

No.	Intended Learning Outcome
1	Develop an understanding of the core ideas and concepts of vector spaces, and be familiar with linear mappings and matrix forms.
2	Be able to solve system of linear equations by using row operations and reduced row echelon forms and tell existence and uniqueness of solutions of a linear system
3	Understand the concept and properties of determinant and matrix operations and be able to obtain eigenvalues and eigenvectors of a matrix or a linear transform.
4	Be able to operate the Gram-Schmidt process and be able to diagonalize a matrix

8. Assessment Scheme

a. Examination Duration: 2 hours (midterm), 3 hours (final)

b. Percentage of coursework, examination, etc:

Assessment

10% by homework

30% by midterm examination

60% by final examination

Assessing Course ILOs

1,2,3,4

1,2,3,4

1,2,3,4

9. Teaching and Learning Activities -

a. Lectures: focus on understanding concepts, theory and applications

b. Tutorials: focus on homework

10. Textbook: Linear Algebra and its Applications, by D. Lay, etc. (6th edition)

11. Midterm: TBA (2 hours).

Final: TBA (3hours)

12. Course Schedule:

Chapter 1: Linear Equations in Linear Algebra

- 1.1 Systems of Linear Equations
- 1.2 Row Reduction and Echelon Forma
- 1.3 Vector Equations
- 1.4 The Matrix Equation $Ax=b$
- 1.5 Solution Sets of Linear Systems
- 1.7 Linear Independence
- 1.8 Introduction to Linear Transformations
- 1.9 The Matrix of a Linear Transformation

Chapter 2: Matrix Algebra

- 2.1 Matrix Operations
- 2.2 The Inverse of a Matrix
- 2.3 Characterizations of Invertible Matrices

Chapter 3: Determinants

- 3.1 Introduction to Determinants
- 3.2 Properties of Determinants

Chapter 4: Vector Spaces

- 4.1 Vector Spaces and Subspaces
- 4.3 Linearly Independent Sets; Bases
- 4.4 Coordinate Systems
- 4.5 The Dimension of Vector Space
- 4.6 Rank

Chapter 5: Eigenvalues and Eigenvectors

- 5.1 Eigenvectors and Eigenvalues
- 5.2 The Characteristic Equation
- 5.3 Diagonalization

Chapter 6: Orthogonality and Least-Squares

- 6.1 Inner Product, Length, and Orthogonality
- 6.2 Orthogonal Sets
- 6.3 Orthogonal Projections
- 6.4 The Gram-Schmidt Process
- 6.5 Least-Squares Problems

Chapter 7: Symmetric Matrices and Quadratic Forms

- 7.1 Diagonalization of Symmetric Matrices
- 7.2 Singular Value Decomposition