# MATH 2111 Matrix Algebra and its Applications

Syllabus - Summer 2022

**Course Home Page**

- Course website:
  - http://canvas.ust.hk

**Instructor**

- Instructor: Dr. Ku, Yin Bon (Albert)
  - Office: Rm 3446, email address: maybku@ust.hk
- TA: Leung Ho Ming
  - Office: Rm 3011, email address: malhm@ust.hk

**Online Meeting Time**

- Lectures L1: Mon, Wed, Fri 1:30pm - 4:20pm. (Jun 22 – July 22)
- Tutorials T1: Mon, Wed, Fri 5:00pm – 5:50pm. (Jun 22 – July 22)

**Course Description**

Duration: one semester. Credits: 3 units.

Systems of linear equations; vector spaces; linear transformations; matrix representation of linear transformations; linear operators, eigenvalues and eigenvectors; similarity invariants and canonical forms.

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

Exclusion(s): MATH 2121, MATH 2131, MATH 2350

**Student Learning Resources**

*Lecture notes:*
Interactive lecture notes can be viewed online.

*Reference:*
Linear Algebra and its Applications by David C. Lay, Stephen R. Lay, Judi J. McDonald 5th edition. Pearson.

**Intended Learning Outcomes**

Upon the end of the course, students should:

1. Develop an understanding of the core ideas and concepts of matrix algebra, linear transformations, eigenvectors and inner product spaces
2. Recognize the power of abstraction and generalization, carry out mathematical work with independent judgement
3. Apply rigorous, analytical and numeric approach to analyze and solve problems using concepts of linear algebra
4. Be able to communicate problem solutions using correct mathematical terminology and good English.

**Assessment Scheme**

| Assessment | Assessing course ILOs |
|---|---|
| Online Homework: 25 % | 1,2,3,4 |
| Final Exam: 75 %. | 1,2,3,4 |

(Note: Final Exam will be held on July 28)

**Teaching Approach**

Scheduled activities: 3 hours (lecture) + 1 hour (tutorial).
Lecture will focus on illustrating the concepts of the course content, while tutorials will focus on examples and problem skills.

**Tentative Course Schedule**

| Week | Content | Remarks |
|---|---|---|
| 1 | • Definition of a vector and its matrix representation<br>• Vector addition and scaling, linear combination, span<br>• Linear independence, basis, dimension<br>• Linear transformations<br>• Systems of linear equations | |
| 2 | • Gaussian elimination<br>• Solving systems of linear equations<br>• Computing the inverse of a matrix<br>• Determinants | |
| 3 | • General vector spaces<br>• Column space and null space<br>• Rank theorem<br>• Eigenvalues and eigenvectors<br>• Diagonalization | |
| 4 | • Inner product and orthogonality<br>• Orthogonal projections and Gram-Schmidt process<br>• Least square method | |