Course number	U-LAS10 20006 LE55		
Course title (and course title in English)	Advanced Linear Algebra Advanced Linear Algebra	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,Chang, Kai-Chun
Group	Natural Sciences	Field(Classification)	Mathematics(Development)
Language of instruction	English	Old group	Group B
Number of credits	2		
Number of weekly time blocks	1	Class style	Lecture (Face-to-face course)
Year/semesters	2025・First semester		
Days and periods	Fri.2	Target year	2nd year students or above
Eligible students	For science students		

[Overview and purpose of the course]

Linear Algebra is an important tool commonly used in many fields, in not only mathematics but also natural sciences, engineering, etc. This course extends the contents in "Linear Algebra A/B" courses (provided majorly for 1st year students) and discusses advanced concepts of linear algebra, such as orthogonality, diagonalization, Singular Value Decomposition (SVD) of a matrix, Jordan canonical form, and their applications to real-world problems, etc.

[Course objectives]

・To acquire the advanced concepts of linear algebra, such as orthogonality, diagonalization, SVD of matrix.
・To understand the applications of linear algebra to real-world problems.

[Course schedule and contents)]

1. Review of linear algebra [2 weeks]
 - Big picture, rank, dimension, LU/LDU factorization, Gauss-Jordan elimination, etc.
 - vector spaces, subspaces, nullspace, complete solutions, four subspaces and their dimensions and orthogonality, etc.

2. Orthogonality and its applications [3 weeks]
 - Orthogonality and orthogonality complement, projections, least square approximations, orthogonal bases, Gram-Schumidt process, etc.

3. Eigenvalues, eigenvectors, and their applications [4 weeks]
 - Eigenvalues and eigenvectors, diagonalization, matrix power, singular value decomposition (SVD) and their application to difference equations, differential equations and Markov process, etc.

4. Jordan canonical form [3 weeks]
- minimal polynomials, generalized eigenvectors, Jordan canonical form, and their applications.

5. Optional topics [2 weeks]
 - numerical solutions, complex vectors and matrices, other applications, etc.

6. Feedback [1 week]

Continue to Advanced Linear Algebra(2)↓↓↓

Advanced Linear Algebra(2)

[Course requirements]

Suggested prerequisites: Calculus A/B and Linear Algebra A/B or Calculus with Exercises A/B and Linear Algebra with Exercises A/B.

[Evaluation methods and policy]

Quizzes or assignments (50%); final examination (50%)

[Textbooks]

Not used

[References, etc.]

（References, etc.）

Strang, G. (2009) 『Introduction to Linear Algebra. 5th ed.』 （Wellesley-Cambridge Press）
Lipschutz, S. and Lipson, M. (2012) 『Linear Algebra, 6th ed.』 （McGraw-Hill）

[Study outside of class (preparation and review)]

Students are expected to spend at least 2 hours per week on preview and review. More than half of that time is spent preparing for class and doing assignments.

[Other information (office hours, etc.)]

Any inquiry to the instructor: chang.kaichun.4z{at}kyoto-u.ac.jp. (replace {at} with @)

[Essential courses]