科目ナンバリング	U-LAS10 20006 LE55						
授業科目名<英訳>	Advanced Linear Algebra Advanced Linear Algebra			担当者所属職名・氏名	工学研究科　准教授　CHANG, Kai-Chun		
群	自然科学科目群		分野(分類)	数学(発展)		使用言語	英語
旧群	B群	単位数	2単位	週コマ数	1コマ	授業形態	講義（対面授業科目）
開講年度・開講期	2026・前期	曜時限	金2	配当学年	主として2回生	対象学生	理系向

[授業の概要・目的]

Linear Algebra is a fundamental tool used extensively across many fields, including mathematics, natural sciences, and engineering. This course builds upon the foundation established in "Linear Algebra A/B" (typically taken in the first year) and explores advanced concepts. Topics covered include orthogonality, diagonalization, the Singular Value Decomposition (SVD) of matrices, and the Jordan canonical form, with a strong focus on their applications to real-world problems.

[到達目標]

・To acquire a deep understanding of advanced linear algebra concepts, including orthogonality, diagonalization, and the Singular Value Decomposition (SVD) of matrices.
・To apply these core linear algebra concepts to effectively solve real-world engineering and scientific problems.

[授業計画と内容]

1. Review of linear algebra [2 weeks]
- Big picture, rank, dimension, solvability, factorization, elimination, etc.
- Vector spaces, subspaces, nullspace, complete solutions, etc.

2. Orthogonality and its applications [4 weeks]
- Four subspaces and their dimensions and orthogonality, orthogonal complements, projections, least square approximations, orthogonal bases, Gram-Schmidt 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]
- Generalized eigenvectors, Jordan canonical form, and their applications.

5. Optional topics [1 week]
- Numerical solutions, complex vectors and matrices, other applications, etc.

6. Feedback [1 week]

[履修要件]

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

Advanced Linear Algebra(2)へ続く↓↓↓

Advanced Linear Algebra(2)

[成績評価の方法・観点]

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

[教科書]

Handouts uploaded to the LMS course site

[参考書等]

（参考書）

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

[授業外学修（予習・復習）等]

Students are expected to dedicate two hours or more per week to course material, primarily for previewing content and reviewing lectures. More than half of this time should be focused on preparing for class and completing assignments.

[その他（オフィスアワー等）]

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

[主要授業科目（学部・学科名）]

理学部