Lingnan University
Department of Economics

Term 1, AY2026-27

Course Title	:	Linear Algebra
Course Code	:	SSC2113
Recommended Study Year	:	Any
No. of Credits/Term	:	3
Mode of Tuition	:	Lecture: section-based
Class Contact Hours	:	3-hour lecture per week
Category in Major Prog.	:	Elective
Discipline	:	Social Sciences
Prerequisite(s)	:	N/A
Co-requisite(s)	:	N/A
Exclusion(s)	:	N/A
Exemption Requirement(s)	:	N/A

Brief Course Description

This course focuses on basic Linear Algebra used in econometrics and in social research. It will cover some basic techniques of matrix arithmetic and algebra, and in particular matrix multiplication and solution of linear equations.

Aims

This course is designed to provide students with a basic knowledge and understanding of Linear Algebra that are used in the social sciences.

Learning Outcomes (LOs)

Upon completion of the course, students will be able to:

1. demonstrate basic knowledge and techniques of matrix algebra;
2. apply the knowledge and techniques of matrix algebra in economics analysis;
3. demonstrate understanding of the basic structure and components of relationships among variables in Econometrics and social research.

Indicative Contents

1. Introduction to Matrices
    a. Basic definition
    b. Matrix addition
    c. Multiplication by a scalar
    d. Matrix multiplication
    e. Applications of matrices

2. Introduction to Vectors
   a. Basic definition
   b. Geometric representation of a vector
   c. Products of vectors
   d. Applications

3. Elementary Matrix Transformation
   a. Elementary row operations
   b. Normal form and rank
   c. Elementary matrices

4. Special matrices
   a. Transpose of a matrix
   b. Symmetric matrix
   c. Skew-Symmetric matrix
   d. Triangular and echelon matrices
   e. Diagonal and scalar matrices
   f. Sub-matrices and partitioning

5. Determinants
   a. Definition of a determinant
   b. Cofactor expansion
   c. Properties of determinants
   d. Rank of a matrix

6. The Inverse matrix
   a. Cofactor matrix and adjoint matrix
   b. Inverse matrix
   c. Properties of an inverse matrix
   d. Solution of n linear equations
   e. Cramer's rule

7. Vector Spaces
   a. Definition
   b. Linear dependence and independence
   c. Basis

8. Eigenvalues, Eigenvectors and Quadratic Forms
   a. The eigenvalues of a matrix
   b. The eigenvectors of a matrix
   c. Quadratic forms

Teaching Method

The basic teaching approach is through a series of lectures coupled with vigorous homework exercises.

Measurement of Learning Outcomes

Learning outcomes are measured by:

1. assignments and quizzes are designed to assess student's comprehension of lecture and assigned readings (LO1, LO2),
2. mid-term tests and final examination assess students' understanding and applications of the techniques to the problem in economics (LO1, LO2, LO3).

Assessment

Continuous Assessment (class participation, attendance, and assignments)	**20%**
Mid-term test	**30%**
Final examination	**50%**
Total	**100%**

Good Practices

1. Students are encouraged to make appointments with the instructor during office hours for individual/group consultation regarding the assigned questions.
2. A course teaching and learning evaluation is conducted after the mid-term test allowing for early feedback from students regarding the course.

Required/ Essential Reading

Kolman, Bernard and David Hill, *Elementary Linear Algebra with Applications*, 9nd Edition, Pearson/Prentice Hall, 2008.

Recommended/ Supplementary Reading

Bretscher, Otto, *Linear Algebra with Applications*, 3rd ed., New Jersey: Peason Prentice Hall, 1997.

Leon, Steven, *Linear Algebra with Applications*, 7th ed., New Jersey: Prentice Hall, 2006.

Nicholson, Keith, Elementary Linear Algebra, 2nd Edition, McGraw Hill, 2004.

Important Notes:

(1) Students are expected to spend a total of 9 hours (i.e. 3 hours of class contact and 6 hours of personal study) per week to achieve the course learning outcomes.

(2) Students shall be aware of the University regulations about dishonest practice in course work, tests and examinations, and the possible consequences as stipulated in the Regulations Governing University Examinations. In particular, plagiarism, being a kind of dishonest practice, is "the presentation of another person's work without proper acknowledgement of the source, including exact phrases, or summarised ideas, or even footnotes/citations, whether protected by copyright or not, as the student's own work". Students are required to strictly follow university regulations governing academic integrity and honesty.

(3) Students are required to submit writing assignment(s) using Turnitin.

(4) To enhance students' understanding of plagiarism, a mini-course "Online Tutorial on Plagiarism Awareness" is available on https://pla.ln.edu.hk/.

(5) Students must adhere to the University's guidelines and practices when using Generative Artificial Intelligence (AI) tools. The official documents "Guidelines for Using GAI Tools at Lingnan University" and "Best Practices for Ethical and Responsible Use of GAI Tools in Course Assessments" can be found here: https://www.ln.edu.hk/tlc/generative-artificial-intelligence/gai-guidelines-bestpractices.

Asessment Rubrics

Rubrics for participation (10%)

Dimensions	Excellent A-, A	Good B- to B+	Fair C- to C+	Pass D, D+	Failure F
Participation	Frequently raises good questions and/or eagerly responds to questions	Often raises good questions and/or eagerly responds to questions	Occasionally raises questions and/or responds to questions	Rarely raises questions and/or responds to questions	Fails to fulfill satisfactory attendance

Rubrics for Assignments, Mid-term Test and Final Exam (10%, 30% and 50%)

Dimensions	Excellent A-, A	Good B- to B+	Fair C- to C+	Pass D, D+	Failure F

Comprehension (8%, 24% and 40%)	Demonstrates a thorough understanding of the relevant concepts. Always or almost always performs the required operations correctly	Demonstrates a good understanding of the relevant concepts. Usually performs the required operations correctly	Demonstrates a fair understanding of the relevant concepts. Sometimes performs the required operations correctly	Demonstrates a superficial understanding of the relevant concepts. Rarely performs the required operations correctly	Demonstrates insufficient understanding or misunderstanding of the relevant concepts. Fails to perform all or most operations correctly
Clarity (2%, 6% and 10%)	Consistently accurate, logical and clear	Generally accurate, logical and clear	Comprehensible and clear with some minor lapses	Comprehensible but there are some major lapses	Largely incomprehensible