

<b>Course Title</b>	:	Linear Algebra
<b>Course Code</b>	:	SSC2113
<b>Recommended Study Year</b>	:	3 and 4
<b>No. of Credits/Term</b>	:	3
<b>Mode of Tuition</b>	:	Lecture-Tutorial
<b>Class Contact Hours</b>	:	3 hours per week
<b>Category in Major Prog.</b>	:	Elective
<b>Discipline</b>	:	Social Sciences
<b>Prerequisite(s)</b>	:	N/A
<b>Co-requisite(s)</b>	:	N/A
<b>Exclusion(s)</b>	:	N/A
<b>Exemption Requirement(s)</b>	:	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. Linear Equations and Matrices
  - a. Systems of linear equations
  - b. Solution sets of linear systems
  - c. Matrices
  - d. Vectors
2. Matrix Algebra
  - a. Matrix operations

- b. Algebraic properties of matrix operations
  - c. Special types of matrices and partitioned matrices
3. Solving Linear Systems
- a. Echelon form of a matrix
  - b. Solving linear systems
  - c. Elementary matrices and the inverse of a matrix
  - d. Equivalent matrices
4. Determinants
- a. Definition of a determinant
  - b. Cofactor expansion
  - c. Properties of determinants
5. Inverse of a matrix
- a. Cofactor matrix and adjoint matrix
  - b. Invertible matrix
  - c. Properties of an invertible matrix
  - d. Solution of n linear equations
  - e. Cramer's rule
6. Vector Spaces
- a. Vector spaces and subspaces
  - b. Linear dependence and independence
  - c. Basis and dimension
  - d. Rank of a matrix
7. Eigenvalues, Eigenvectors and Quadratic Forms
- a. The eigenvalues of a matrix
  - b. The eigenvectors of a matrix
  - c. Quadratic forms

### **Teaching Method**

Lectures combined with tutorials and vigorous homework exercises.

### **Measurement of Learning Outcomes**

Learning outcomes are measured by:

1. tutorials 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

1. Attendance and participation *	10%
2. Two quizzes (5% each)	10%
3. Mid-term test	30%
4. Final examination	50%
Total	100%

\* All students are required to attend both lectures and tutorials. Grade will be deducted for absence without justifiable reasons.

### 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*, 9<sup>th</sup> Edition, Peason/Prentice Hall, 2008.

### Recommended/ Supplementary Reading

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

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

Nicholson, Keith, *Elementary Linear Algebra*, 2<sup>nd</sup> 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/>.

**Assessment Rubrics**

**Rubrics for attendance and participation (10%)**

Dimensions	Excellent A-, A	Good B- to B+	Fair C- to C+	Pass D, D+	Failure F
Attendance (4%)	No absence	1-2 absences without proper reason	3-4 absences without proper reason	5-6 absences without proper reason	7 or more absences without proper reason
Participation (6%)	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	Never raises questions or responds to questions

**Rubrics for Quizzes, 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	Generally accurate, logical	Comprehensible and clear with some minor	Comprehensible but there are some major	Largely incomprehensible

	clear	and clear	lapses	lapses	
--	-------	-----------	--------	--------	--