MATH 2131 – Honors in Linear and Abstract Algebra I

Fall 2026 Course Outline

Lecture

Instructor:	**Prof. IP, Ivan Chi-Ho**
Office:	Room 3470 (Lift 25-26)
Office Hour:	By appointment
E-mail:	ivan.ip@ust.hk

Tutorial

TA:	**HE, Dongdong**	**Hou, Jiantong**
E-mail:	dheaf@connect.ust.hk	jhouap@connect.ust.hk

Meeting Time and Venue

Lecture:	Tuesday, Thursday	16:30 – 17:50	Lecture Theatre K
Session T1A:	Monday	19:00 – 19:50	G009B, CYT Bldg
Session T1B:	Monday	16:30 – 17:20	Rm 2302, Lift 17-18

Course Description

This is the first in the sequence MATH 2131 – MATH 3131 of honors courses in linear algebra and abstract algebra, with particular emphasis on rigorous mathematical reasoning.

This course will cover the basics of linear algebra over any field in the finite-dimensional setting.

Topics include: abstract vector space, linear transformation and matrix, determinant, inner product space, spectral theory, positive definiteness, complex matrix, invariant subspace, canonical forms, quotient and dual spaces.

Prerequisite:	Grade A in AL Pure Mathematics; or grade A- or above in MATH 1014/MATH 1020/MATH 1024
Exclusion:	MATH 2111, MATH 2121, MATH 2350
Credits:	4

Intended Learning Outcomes

Upon completion of this course, students are expected:

1. Develop an understanding of the core ideas and concepts of Linear Algebra in the abstract setting
2. Be able to recognize the power of abstraction and generalization, and to carry out mathematical work with independent judgment.
3. Be able to apply rigorous, analytic, and numeric approach to analyze and solve problems.
4. Be able to explain clearly concepts and calculations from Linear Algebra.

Assessment Scheme

There will be about 6 Homework Sets, due on Sunday night biweekly.

Thee will be one 3-hour Midterm Exam, and one 3-hour Final Exam.

	Weight	Assessment ILOs
Homework	16%	1,2,3,4
Midterm Examination	29%	1,2,3,4
Final Examination	55%	1,2,3,4

Grading Scheme

Letter grades will be assigned depending on overall performance.
Obtaining a total point of 90% or above, or top 10% will be guaranteed an A+.
Obtaining a total point of 70% or above will be guaranteed an A-range.
Obtaining a total point of 50% or above will be guaranteed a B-range.
Obtaining a total point of 30% or above will be guaranteed a passing grade.

Grades	**Short Description**	**Elaboration on subject grading description**
A	Excellent Performance	Demonstrates a comprehensive grasp of abstract linear algebra, on both the conceptual understanding and computational aspects.
B	Good Performance	Shows good knowledge and understanding of abstract linear algebra, but did not master the subject completely.
C	Satisfactory Performance	Possesses adequate knowledge of linear algebra, but may not perform well even in the normal linear algbera stream.
D	Marginal Pass	The student is only able to recall some fragments of topics and is able to complete some of the easiest computations.
F	Fail	The student does not have sufficient understanding of even some fragments of topics, and is not even able to complete some of the easiest computations.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity — HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

Late submission Policy. To ensure fairness for students who submit assignments on time, a penalty for late submission is listed as follows, according to the timestamp of Canvas:

- Late submission between 0 to 24 hours, 50% penalty will be applied.
- Late submission for more than 24 hours will not be accepted.

Make-up Exam Policy. Make-up Midterm Exam will only be considered with at least a 4-hour notice and with proper support documents. Make-up Final will follow the make-up exam policy set by ARO.

Communication and Feedback. Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include comments and corrections. Students who have further questions about the feedback including marks should consult the instructor or TA within five working days after the feedback is received through email or discord.

Course AI Policy. The use of Generative AI is permitted, but students should be critical of the responses generated by the AI and do not blindly copy the generated responses to your homework. We encourage the submission of handwritten homework.

Teaching and Learning Activities

Aside from lectures, to master this course students are required to do as many exercises as they can to get familiar with the subject. A lot of the exercises are available in the references.

- We will work through problems provided in Worksheet format during every lecture, part of them are Examples from the lecture notes.
- Tutorial Problem Sets will be discussed during the Tutorial Session. Solutions are available after each tutorial.

Student Learning Resources

Lecture Notes written by the instructor.
Lecture Slides and **Lecture Videos** will also be available on canvas after class.

References:

1. *Linear Algebra Done Right*, by S. Axler
2. *Linear Algebra Done Wrong*, by S. Treil
3. *Linear Algebra*, by J. Liesen and V. Mehrmann
4. *Linear Algebra*, Lecture Notes by M. Yan

Tentative Schedule

Week 1	Abstract Vector Spaces
Week 2	Abstract Vector Spaces (cont'd)
Week 3	Linear Transformations
Week 4	Linear Transformations (cont'd)
Week 5	Determinant
Week 6	Inner Product Space
Week 7	Inner Product Space (cont'd)
Week 8	Spectral Theory
Week 9	Positive Definite Matrix
Week 10	Complex Matrices
Week 11	Invariant Subspaces
Week 12	Canonical Forms
Week 13	Quotient and Dual Spaces