City University of Hong Kong
Course Syllabus

offered by College/School/Department of _Mathematics_____
with effect from Semester __A____ 20_19_ / _20_

Part I Course Overview

Course Title:	**Linear Algebra**
Course Code:	**MA2503**
Course Duration:	**One Semester**
Credit Units:	**4**
Level:	**B2**
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
Medium of Instruction:	**English**
Medium of Assessment:	**English**
Prerequisites: *(Course Code and Title)*	**Grade B or above in MA1201 Calculus & Basic Linear Algebra II and subject to approval from MA must be obtained; or** **Grade C- or above in MA1301 Enhanced Calculus & Linear Algebra II**
Precursors: *(Course Code and Title)*	**Nil**
Equivalent Courses: *(Course Code and Title)*	**Nil**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. Abstract

(A 150-word description about the course)

This course introduces the theory and applications of linear algebra. It will help students to develop a logical and systematic understanding of the core material of linear algebra, and apply linear algebra methods to create and formulate mathematical models in science and engineering. It is the first course in the programme BSCM training students in abstract and logic thinking.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs[#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	explain at high levels concepts from linear algebra.	5%	√		
2.	evaluate mathematical quantities of matrices and vector spaces by Gaussian elimination, diagonalization, and other algorithms.	25%		√	
3.	develop a logical and systematic understanding of the structure of the Euclidean vector spaces, and demonstrate this in some practical problems.	15%	√	√	
4.	rigorously prove mathematical statements in linear algebra.	20%		√	√
5.	apply linear algebra methods to various subjects, and create and formulate mathematical models to a range of problems in science and engineering involving linear structures.	15%	√	√	√
6.	the combination of CILOs 1-5	20%	√	√	√
		100%			

** If weighting is assigned to CILOs, they should add up to 100%.*

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

A3: *Accomplishments*
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

Indicative of likely activities and tasks students will undertake to learn in this course. Final details will be provided to students in their first week of attendance in this course.

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5	6	

Lectures	Learning through **teaching** is primarily based on lectures.	✓	✓	✓	✓	✓	✓	40 hours in total
Tutorials	Learning through **tutorials** is primarily based on interactive problem solving allowing instant feedback.		✓					4 hours
				✓				4 hours
					✓			2 hours
		✓				✓		2 hours
Assignments	Learning through **take-home assignments** helps students understand basic mathematical concepts and fundamental theory of linear algebra, and develop the ability of proving mathematical statements rigorously.	✓	✓	✓	✓	✓		after-class
Online applications	Learning through **online examples for applications** helps students create and formulate simple mathematical models and apply to some problems in science and engineering.					✓		after-class
Math Help Centre	Learning activities in **Math Help Centre** provides students extra help.		✓	✓	✓			after-class
Lectures	Learning through **teaching** is primarily based on lectures.	✓	✓	✓	✓	✓	✓	40 hours in total

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

30% Coursework

70% Examination (Duration: 3 hours, at the end of the semester)

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5	6		
Continuous Assessment: __30__%								
Test		✓		✓			30%	Questions are designed for the first part of the course to see how well the students have learned the basic concepts and fundamental theory of linear algebra, and have

								developed the ability of proving mathematical statements rigorously.
Hand-in assignments	✓	✓	✓	✓	✓		0%	These are skills based assessment to enable students to demonstrate the basic concepts and fundamental theory of linear algebra and identify their applications.
Formative take-home assignments						✓	0%	The assignments provide students chances to demonstrate their achievements on linear algebra learned in this course.
Examination: (duration: 3 hrs)						✓	70%	Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be skills and understanding based to assess the student's versatility in linear algebra.
** The weightings should add up to 100%.*							100%	

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Test	1.1 UNDERSTANDING of the basic concepts and theory of linear algebra 1.2 ABILITY to PROVE mathematical statements rigorously	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Hand-in Assignments	2.1 DEMONSTRATION of the understanding of the basic materials	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Formative take-home assignments	3.1 DEMONSTRATION of the understanding of the basic materials	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	4.1 DEMONSTRATION of skills and versatility in linear algebra	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

Matrices and Gaussian Elimination. Vector Spaces and Linear Equations. Orthogonality. Determinants. Eigenvalues and Eigenvectors. Linear Transformations. Quadratic Form and Positive Definite Matrices. Orthogonal and Unitary Transformation.

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	(Meyer 2000) Matrix Analysis and Applied Linear Algebra, by C. D. Meyer, SIAM 2000. (a good blend of theory and application, topics are well motivated)
2.	
3.	
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2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	(Trefethen and Bau 1997) Numerical Linear Algebra, by L. N. Trefethen and D. Bau III, SIAM 1997. (nice introduction to numerical linear algebra, suitable for beginners)
2.	(Golub and van Loan 1996) Matrix Computations (3rd edition), by G. H. Golub and C. F. van Loan, Johns Hopkins University Press 1996. (the "Bible" on numerical linear algebra, comprehensive and authoritative, very well written; 4th edition just came out)
3.	(Axler 2004) Linear Algebra Done Right (2nd edition), by S. Axler, Springer 2004. (advanced text suitable for math majors and graduates, very well written and unique in its determinant-free approach)
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