MA2503: LINEAR ALGEBRA

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Linear Algebra

Subject Code
MA - Mathematics
Course Number
2503

Academic Unit
Mathematics (MA)

College/School
College of Science (SI)

Course Duration
One Semester

Credit Units
4

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
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
Nil

Equivalent Courses
Nil

Exclusive Courses
MA1503 Linear Algebra with Applications

Part II Course Details

Abstract

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.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	explain at high levels concepts from linear algebra.	5	x		
2	evaluate mathematical quantities of matrices and vector spaces by Gaussian elimination, diagonalization, and other algorithms.	25		x	
3	develop a logical and systematic understanding of the structure of the Euclidean vector spaces, and demonstrate this in some practical problems.	15	x	x	
4	rigorously prove mathematical statements in linear algebra.	20		x	x
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	x	x	x
6	the combination of CILOs 1-5	20	x	x	x

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 real-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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Learning through teaching is primarily based on lectures.	1, 2, 3, 4, 5, 6	40 hours in total

2	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	2	4 hours
3	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	3	4 hours
4	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	4	2 hours
5	Tutorials	Learning through tutorials is primarily based on interactive problem solving allowing instant feedback.	1, 5	2 hours
6	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.	1, 2, 3, 4, 5	after-class
7	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.	5	after-class
8	Math Help Centre	Learning activities in Math Help Centre provides students extra help.	2, 3, 4	after-class
9	Lectures	Learning through teaching is primarily based on lectures.	1, 2, 3, 4, 5, 6	40 hours in total

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Test	2, 4	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.
2	Hand-in assignments	1, 2, 3, 4, 5	0	These are skills based assessment to enable students to demonstrate the basic concepts and fundamental theory of linear algebra and identify their applications.
3	Formative take-home assignments	6	0	The assignments provide students chances to demonstrate their achievements on linear algebra learned in this course.

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

3

Additional Information for ATs

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

Assessment Rubrics (AR)

Assessment Task

Test

Criterion

1.1 UNDERSTANDING of the basic concepts and theory of linear algebra

1.2 ABILITY to PROVE mathematical statements rigorously

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
Hand-in Assignments

Criterion
2.1 DEMONSTRATION of the understanding of the basic materials

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
Formative take-home assignments

Criterion
3.1 DEMONSTRATION of the understanding of the basic materials

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
Examination

Criterion
4.1 DEMONSTRATION of skills and versatility in linear algebra

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
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.

Reading List

Compulsory Readings

	Title
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)

Additional Readings

	Title
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)