

Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): MATH 1120 LINEAR ALGEBRA (3,3,1)

approved by Sci. Board at Oct.18,2011

Course Aims: Linear equations, matrices, determinants. Introduction to vector spaces and linear transformations and bases. Inner products and orthogonality. Eigenvalues and eigenvectors; diagonalization. Least squares problems. Applications. The course emphasizes matrix and vector calculations and applications. Numerical experiments with Matlab© in advanced lecture.

Prerequisite: Year one standing

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Learning Outcomes (LOs):

Upon successful completion of this course, students should be:

No.	Learning Outcomes (LOs)
	Knowledge
1	Able to understand the fundamental ideas of linear algebra in the setting of R^n
2	Able to tie vector space ideas into the study of linear systems
3	Able to develop a dynamic and graphical view of matrix-vector multiplication
4	Able to understand the basic concepts of vector spaces
5	Able to understand the basic concepts of eigenvectors and eigenvalues
6	Able to apply the Gram-Schmidt orthogonalization process
7	Able to apply the fundamental principles of linear algebra in a selection of applications
8	Able to prove most of the theorems formally
	Skills
9	Able to visualize the geometric interpretation of ideas in linear algebra courses
10	Able to use Matlab for exploring the basic mathematical and numerical issues in linear algebra
11	Able to apply the concepts of eigenvectors and eigenvalues to discrete and continuous dynamical systems
12	Able to understand and apply the numerical aspects of linear algebra in computer calculations
	Attitude
13	Able to understand the importance of linear algebra and its applications in many branches of mathematics

Assessment:

No.	Assessment Methods	Weighting	Remarks
1	Continuous Assessment	50%	Continuous assessments, comprising in-class exercise, tutorials, assignments and tests, are designed to measure how well the students have learned the basic concepts and fundamental theory of linear algebra and some applications.
2	Final Examination	50%	Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be understanding and skills based to assess the student's versatility in linear algebra.

Learning Outcomes and Weighting:

Content	LO No.	Teaching (in hours)
I. Matrices and Systems of Linear Equations	1–3, 7–12	9
II. Eigenvalues and Eigenvectors	5, 7–12	6
III. Vector Spaces	4, 7–12	9
IV. Linear Transformations	6, 7–12	9
V. Further Topics	6, 7–12	6

Textbook: W.C. Shiu and C.I. Chu, *Linear Algebra*, 2nd Ed., McGraw Hill, 2006.

Course Content in Outline:

	<u>Topic</u>	<u>Hours</u>
I.	Matrices and Systems of Linear Equations	9
	(a) Operations on Matrices	
	(b) Elementary Row Operations	
	(c) Solutions to Systems of Linear Equations	
	(d) Row Echelon Form and Rank	
	(e) Determinants	
II.	Eigenvalues and Eigenvectors	6
	(a) Motivation for Eigenvalues and Eigenvectors	
	(b) Diagonalisation of Matrices	
III.	Vector Spaces	9
	(a) Introduction to Vector Spaces and Subspaces	
	(b) Linear Independence and Spanning Sets	
	(c) Bases and Dimension	
	(d) Row Space and Column Space	
	(e) Sums of Subspaces	
IV.	Linear Transformations	9
	(a) Coordinate Vectors	
	(b) Change of Bases	
	(c) Linear Transformations and Matrix Representations	
	(d) Dimension Formula	
V.	Further Topics	6
	Choice of topics selected from the following list:	
	(a) Similarity of Matrices	
	(b) Inner Product and Orthogonality	
	(c) The Gram-Schmidt Process	
	(d) More on Diagonalisation of Matrices	
	(e) Quadratic Forms	