Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units): **MATH 2207 Linear Algebra (3,3,1)**

Course Aims: Introduction to linear equations, matrices, determinants, vector spaces and linear transformations, bases, inner products, orthogonality, eigenvalues and eigenvectors, diagonalization, least squares problems and other applications. The course emphasizes matrix and vector calculations and applications.

Prerequisite: None

Prepared by: Leevan Ling, K.H. Law, W.C. Shiu

Course Intended Learning Outcomes (CILOs):

Upon successful completion of this course, students should be able to:

No.	Course Intended Learning Outcomes (CILOs)
1	Explain the concept/theory in linear algebra, to develop dynamic and graphical views to the related issues of the chosen topics as outlined in "course content," and to formally prove theorems
2	Recognize the basic applications of the chosen topics and their importance in the modern science
3	Develop simple mathematical models, and apply basic linear algebra techniques learned from the chosen topics to solve simple problems
4	Report and communicate effectively with others and present mathematical results in a logical and coherent fashion
5	Articulate the power and beauty of mathematics, and solve problems independently and collaboratively as part of a team

Teaching & Learning Activities (TLAs)

CILO	TLAs will include the following:
1,2,5	Simple real life problems will be used in lectures to motivate the concepts, followed by discussions of rigorous technical details. Students will then be required to consolidate the knowledge by further reading and formulate their knowledge via discussions and exercises in the tutorials.
3-5	Problems in sophisticated real life situations will be given in lectures, tutorials and assignments. In lectures the instructor will demonstrate how to formulate and solve the problems and discuss why a particular method is used. Students will then be required to attempt the tutorial and assignments questions. In tutorials they have to explain verbally how they would formula and solve the problem to the class, followed by more thorough discussions led by instructor/teaching assistants. For the assignments, they have to present their formulations and solutions in written form.

Assessment:

No.	Assessment Methods	Weighting	CILO Addressed	Remarks
1	Continuous Assignments	30%	1-5	Continuous Assignments, including quizzes, homework and midterm examination, are designed to measure how well the students have learned the basic concepts and fundamental theory of linear algebra and some applications. These continuous assessments include, but not limited to, in class discussions and problem solving exercises.
2	Final Examination	70%	1-4	Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be analysis and skills based to assess the student's versatility in linear algebra.

Course Intended Learning Outcomes and Weighting:

Content	CILO No.	Teaching (in hours)
I. Linear Equations	1-5	9
II. Matrix Algebra	1,3-5	9
III. Determinants	1-5	3
IV. Vector Spaces	1,3-5	6
V. Eigenvalues and Eigenvectors	1-5	6
VI. Orthogonality and Least Squares	1-5	6

Textbook:
1. W.C. Shiu and C.I. Chu, *Linear Algebra*, (Update) 2nd Ed., McGraw Hill, 2012.
2. David C. Lay, *Linear Algebra and Its Applications*, (Update) Third Edition, Pearson.

Course Content in Outline:

	Topic	**Hours**
I.	Linear Equations a. Systems of Linear Equations, Row Reduction and Echelon Form. b. The Matrix Equation $Ax=b$. c. Solution Sets of Linear Systems. d. Applications of Linear Systems.	9
II.	Matrix Algebra a. Matrix Operations. b. The Inverse of a Matrix. c. Characterizations of Invertible Matrices. d. Subspaces of F^n, Basis, Dimension and Rank. e. Linear Independence. f. Null spaces, Column spaces and Linear Transform	9
III.	Determinants a. Introduction to Determinants. b. Properties of Determinants.	3
IV.	Vector Spaces a. Introduction to vector spaces b. Coordinate Systems c. Introduction to Linear Transformations. d. Introduction to Rank and changing basis.	6
V.	Eigenvalues and Eigenvectors a. The Characteristic Equation. b. Diagonalization. c. Eigenvectors	6
VI.	Orthogonality and Least Squares a. Inner Product, Length and Orthogonality. b. Orthogonal Sets. c. Orthogonal Projections. d. The Gram-Schmidt Process. e. Least-Squares Problems. f. Applications to Linear Models.	6