Hong Kong Baptist University
Faculty of Science
Department of Mathematics

Title (Units):	**MATH7030 NUMERICAL LINEAR ALGEBRA (3,3,0)**
Syllabus Reviewed by:	H.C. Huang, L.Z. Liao, W.M. Xue
Prerequisite:	Postgraduate standing or Consent of the instructor
Objectives:	To provide a thorough discussion of the advanced topics and state of art development in numerical linear algebra. This course emphasizes on both the theoretical analysis and the computer applications of numerical linear algebra in various areas.
Calendar Description:	This subject covers the advanced topics in numerical linear algebra. Theoretical issues as well as practical computer applications will be addressed.
Textbook:	L.N. Trefenthen and D. Bau III, Numerical Linear Algebra, SIAM, 1997.
	References: G. Golub and C. Van Loan, Matrix Computation, 3rd Ed., Johns Hopkins University Press, 1996. J.W. Demmel, Applied Numerical Linear Algebra, SIAM, 1997. N.J. Higham, Accuracy and Stability of Numerical Algorithms, SIAM, 1996. P.E. Gill, W. Murray and M.H. Wright, Numerical Linear Algebra and Optimization, Vol. 1, Addison-Wesley, 1991. W. Hager, Applied Numerical Linear Algebra, Prentice Hall, 1988.
Software:	Matlab, LAPACK
Assessment:	Continuous assessment including Project (50%)
	Examination (50%)
Remark:	If this course is offered together with MATH3830, more difficult questions will be required for postgraduate students in both assignments and examinations.

Course Content in Outline:

Topic	Hours
I. Fundamentals	3
A. Vector Space and Matrix	
B. Norms	
C. Eigenvalues and Jordon Canonical Form	
D. Singular Value Decomposition	
II. Conditioning and Stability	6
A. Conditioning and Condition Numbers	
B. Floating Point Arithmetic	
C. Stability	
III. QR Factorization and Least Squares	7
A. Projectors	
B. QR Factorization and Gram-Schmidt Orthogonalization	
C. Householder Triangularization	
D. Least Squares Problems	
E. Conditioning and Stability	
IV. Systems of Equations	6
A. Gaussian Elimination	
B. Pivoting	
C. Stability Analysis	
D. Cholesky Factorization	
V. Eigenvalues	9
A. Supplementary Knowledge of Eigenvalues Problem	
B. Reduction to Hessenberg or Tridiagonal Form	
C. Rayleigh Quotient, Inverse Iteration	
D. QR Algorithm	
E. Computing the SVD	
VI. Iterative Methods	10
A. Overview of Iterative Methods	
B. Arnoldi Iteration	
C. Lanczos Iteration	
D. Conjugate Gradients	
E. Biorthogonalization Methods	
F. Preconditioning	