MATH 5718: APPLIED LINEAR ALGEBRA
(3 credit hrs)

Course Description:

Fall. Topics include: vector spaces, practical solution of systems of equations, projections, eigenvalues and eigenvectors, unitary transformations, Schur QR, singular value decompositions, similarity transformations, Jordan forms, and positive definite matrices.

Course pre-requisite: MATH 3191

Topical Syllabus:

- Vector spaces, subspaces, sums, and direct sums.
- Span and linear independence, dimension and bases.
- Linear maps, null spaces and ranges, invertibility, the matrix of a linear map, matrix-matrix multiplication, change of basis.
- Trace. Determinant of an operator. Determinant of a matrix. Volume.
- Eigenvalues and Eigenvectors. Invariant Subspaces. The characteristic Polynomial. The Cayley-Hamilton theorem. The minimal polynomial. Diagonalization. Reduction to Schur form. Reduction to Jordan form. Generalized eigenvectors.
- Matrix norms, induced norms, spectral radius.
- Inner-Product Spaces. Orthonormal Bases. Orthogonal Projections and Minimization Problems. Moore-Penrose pseudoinverse. Linear Functionals and Adjoints.
- Operators on Inner-Product Spaces. Isometries. Self-Adjoint and Normal Operators. The Spectral Theorem. Positive-Definite Operators.
- Singular-Value Decompositions and Polar Decomposition.
- The Courant-Fischer theorem.
- Positive Matrices. The Perron-Frobenius Theorem.

Recommended Text: R.A. Horn and Ch.R. Johnson, Matrix analysis.

Last updated: March 25, 2010