

## **Course Outline for EE712: Matrix Computations in Signal Processing**

**Instructor:** Dr. J. P. Reilly: ITB A312 x22985  
**Web Page:** [www.ece.mcmaster.ca/~reilly/ece712](http://www.ece.mcmaster.ca/~reilly/ece712)  
**Text:** Golub and Van Loan, Matrix Computations, 3rd Ed. Johns Hopkins U. Press  
**References:** G. Strang: Linear Algebra and its Application, 3rd. Ed.  
James W. Demmel: Applied Numerical Linear Algebra

### **Course Outline:**

1. Review of fundamental concepts of linear algebra
2. Covariance matrices and the Karhunen-Loeve expansion, applications
3. Singular value decomposition (svd), eigendecomposition (ed).
4. Gaussian elimination, condition number, and error analysis
5. Cholesky decomposition and applications.
6. Linear Least Squares Estimation: background, normal equations, variance of solution, full-rank and rank-deficient solution using the svd.
7. The QR decomposition: Householder, Givens, fast Givens, and modified Gram-Schmit techniques, systolic arrays.
8. Solving least-squares using the QR decomposition: the full-rank and rank-deficient case.
9. Toeplitz systems.

**Course evaluation is by final exam and assignments.**