

# COM 521500 Mathematical Methods for Signal Processing I

## Goal

To lay the foundations of advanced linear algebra and matrix theory, on which many advanced signal processing techniques relies. Also serve as a prerequisite for advanced concepts such as convex optimization theory.

## Prerequisite

A good background in basic linear algebra is helpful, but not required.

## Course Outline

- Vector spaces, subspaces, and norms. Basic concepts in matrices.
- Eigendecomposition
- Singular value decomposition
- LU factorization, and Cholesky factorization
- Least squares
- QR decomposition
- Total least squares, and robust least squares
- Toeplitz matrices
- Kronecker products and vec operator

## Recommended Readings

Gene H. Golub and Charles F. van Loan, *Matrix Computations*, John Hopkins University Press, 1996.

Prof. J. Reilly's online course notes on Matrix Computations  
[http://www.ece.mcmaster.ca/~reilly/html/gradcourse/graduate\\_courses.html](http://www.ece.mcmaster.ca/~reilly/html/gradcourse/graduate_courses.html)

Todd K. Moon and Wynn C. Stirling, *Mathematical methods and algorithms for signal processing*, Prentice Hall, 2000.

Roger A. Horn and Charles R. Johnson, *Matrix analysis*, Cambridge University Press, 1990.

## **Assessment Method**

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|---------------|-----|
| 1 Assignment  | 30% |
| 1 Project     | 40% |
| 1 Examination | 30% |

Important: If you commit plagiarism, you will receive no score for the assignment, project or exam. that you cheated. You may also be asked to withdraw from this course, depending on the seriousness. The assignment and project must be handed in on time. Late assignments and projects will not be accepted. Anyone who does not attend the exam. will be considered dropping this course, and hence will fail.