

Prefix, Number and Name of Course: ACM 630 Numerical Linear Algebra
Credit Hours: 1

In Class Instructional Hours: 1 **Labs:** 0 **Field Work:** 0

Catalog Description:

Prerequisite: MAT 202 OR MAT404

Numerical algorithms for linear algebra problems, matrix operations, matrix decompositions, solving systems of linear equations.

Reasons for Addition or Revision:

To create a one-semester-hour core module for the graduate Professional Applied and Computational Mathematics program where students will study numerical algorithms for linear algebra problems arising from image and signal processing, computational finance, material science simulations, structural biology, data mining, and bio-informatics, fluid dynamics, and many other areas.

Student Learning Outcomes: Students will:	Content References:	Assessment:
1. learn techniques of matrix operations and decompositions.	I	1. Group work in class, individual homework assignments, exams.
2. solve systems of linear equations by use different methods.	I, II, IV	2. Group work in class, individual homework assignments, exams, and computer projects
3. utilize computer software for diverse practical settings.	I-IV	3. Group computer projects.
<p>Course Content:</p> <p>I. Basic concepts A. Type of matrices in numerical analysis B. Algorithms for matrix operations C. Matrix decompositions</p> <p>II. Solving systems of linear equations A. Gaussian elimination B. LU decomposition C. SV decomposition D. QR decomposition E. Iterative methods</p> <p>III. Selected applications A. The assignment problem</p>		

- B. Markov chains
 - C. Graph theory
 - D. Leontief economic models
 - E. Computer graphics
- IV. Use of numerical linear algebra software

Resources:

Scholarships in the Field:

Allaire, G. and Craig, A. (translator), *Numerical Analysis and Optimization: An Introduction to Mathematical Modeling and Numerical Simulation*, Oxford Press, 2007.

Atkinson, K. and Han, W., *Elementary Numerical Analysis*, John Wiley & Sons Inc, 2003.

Atkinson, K. E., *Elementary Numerical Analysis*, John Wiley & Sons, New York, 1993.

Burden, R. L. and Faires, J. D., *Numerical Analysis*, Boston, MA: PWS-Kent, 1989. Fourth Edition.

Curtis, F.G. and Wheatley, P. O., *Applied Numerical Analysis*, Addison-Wesley, 2008.

Gilat, A., *MATLAB: An Introduction with Applications: (2nd ed.)*, John Wiley & Sons, 2004.

Griffiths, D. V., and Smith, I. M., *Numerical Methods for Engineers*, CRC Press, 2006.

Golub, G. H. and Van Loan, F. C., *Matrix Computations*, Baltimore, MD: Johns Hopkins University Press, 1983, 1989. Second Edition.

Higham, N. J., *Accuracy and Stability of Numerical Algorithms (2nd ed.)*, SIAM, 2002.

Leader, J. J., *Numerical Analysis and Scientific Computation*, Addison Wesley, 2004.

Liu, J.P., *Focus on Numerical Analysis*, Nova Science Pun Inc., 2006.

Mathews, J. H., *Numerical Methods for Computer Science, Engineering and Mathematics*, Prentice Hall, New Jersey, 1987.

Richard, L. B. and Faires, J. D., *Numerical Analysis*, Thomson Brook/Cole, 2005.

Press, W. H., et al., *Numerical Recipes: The Art of Scientific Computing*, New York, NY: Cambridge University Press, 1986.

Sewell, G., *The Numerical Solution of Ordinary and Partial Differential Equations*, New York, NY: Academic Press, 1988.

Smith, W. A., *Elementary Numerical Analysis*, Prentice-Hall, New Jersey, 1986.

Steinberg, D. I., *Computational Matrix Algebra*, McGraw-Hill, New York, 1974.

Wilkinson, J. H., *The Algebraic Eigenvalue Problem*, New York, NY: Oxford University Press, 1965, 1988.

Periodicals:

Electronic Journal of Boundary Elements

Electronic Transactions on Numerical Analysis

IMA Journal of Numerical Analysis

International Journal of Numerical Analysis and Modeling

International Journal for Numerical Methods in Engineering Advance in Numerical Analysis – An Open Access Journal Journal of Numerical Analysis

Industrial and Applied Mathematics ESAIM: Mathematics Modeling and Numerical Analysis

Journal of Online Mathematics and its Applications

SIAM Journal on Numerical Analysis

Electronic and/or Audiovisual Resources:

Introduction to Numerical Analysis for Engineering

(<http://ocw.mit.edu/OcwWeb/Mechanical-Engineering/2-993JSpring-2005/CourseHome/>).

Numericalmathematics.com (<http://www.numericalmathematics.com>).

Numerical analysis DMOZ category (http://www.dmoz.org/Science/Math/Numerical_Analysis/).

Numerical Analysis Project (<http://math.fullerton.edu/mathews/numerical.html>).

Numerical Computing Resources on the Internet

(<http://www.indiana.edu/~statmath/bysubject/numerics.html>).

Numerical Methods Resources

(<http://www.onesmartclick.com/engineering/numerical-methods.html>).

Numerical-methods.com (<http://www.numerical-methods.com/>).

Numerical Methods – Online Course (<http://www.math.jct.ac.il/~naiman/nm/>).

Numerical Recipes: The Art of Scientific Computing (third edition) (www.nr.com).

Scientific computing FAQ (<http://mathcom.com/corpdirechinfo.mdir/index.html>).