

**Course Outline for:** MATH 2033/CSCI 2033 Elementary Computational Linear Algebra**A. Course Description**

1. 4 credits
2. 4 lecture hours per week
3. Prerequisites: MATH 1510
4. Co-prerequisites: None
5. MnTC Goals: None

Matrices and linear transformations, basic theory. Linear vector spaces. Inner product spaces. Systems of linear equations, Eigenvalues, and singular values. Algorithms and computational matrix methods using MATLAB. Use of matrix methods to solve a variety of computer science problems.

**B. Date last reviewed:** December 29, 2017**C. Outline of Major Content Areas**

Emphasis will be on computational issues and applications, particularly related to Computer Science, but will include a formal introduction to the basic theory.

1. Elementary Linear Mappings
2. Graphs and Matrices
3. Elementary Matlab Programming
4. Systems of Linear Equations
5. Theory of Linear Equations Determinants
6. Vector Spaces
7. Abstract Linear Spaces
8. Inner Products
9. Orthogonality
10. Least Squares.
11. Norms, Condition Numbers, and Numerical Stability.
12. Abstract linear transformations.
13. Eigenvalues
14. Singular Value Decomposition

**D. Course Learning Outcomes**

Upon successful completion of CSCI 2033/MATH 2033, students will be able to:

1. Apply matrix reduction methods to solve and describe solutions sets of linear systems.
2. Perform matrix operations.
3. Do row reductions on matrices and obtain echelon
4. Determine linear Independence of vectors.
5. Give characterizations of invertible matrices
6. Compute algebraically with matrices; products and inverses
7. State and use properties of determinants and employ Cramer's Rule

8. Describe the structure and characteristics of vector spaces, subspaces, and linear transformations between vector spaces
9. Compute eigenvalues and eigenvectors
10. Determine orthogonality and use least squares approximations for a straight line
11. Apply Linear Transformations

**E. Methods for Assessing Student Learning**

The instructor will choose from among various evaluation techniques including – but not limited to – in-class testing, take-home testing, assignments, quizzes, attendance, group or individual projects, and research. The instructor will also choose a method for end-of-the-semester evaluation.

- F. Special Information:** Before taking CSCI 2033/MATH 2033, students are expected to have mastered and retained the material covered in a standard first-year Calculus sequence: functions of one variable and their properties and graphs, two-dimensional analytic geometry, the definition and development and applications of differentiation and integration. In addition, high-level problem solving ability will be assumed as well as mastery of algebraic manipulations, graphical visualization, and numerical computations. To do well in this course, students should have excellent work habits and be dedicated to a complete understanding of concepts and their application.

Students will need access to the computers and Matlab software in the Normandale Community College Computer Center or on another system of their choice.