MA339: Applied Linear Algebra
Course Syllabus—Fall 2009

General Information:

- **Professor:** Scott R. Fulton (367 Science Center, 268-2379, fulton@clarkson.edu).
- **Office hours:** as posted or by appointment (check with me in class, call, or send email).
- **Course website:** See Blackboard for assignments, announcements, and other information.
- **Prerequisite:** MA232 (or MA132 and familiarity with matrix algebra).
- **Required Text:** *Linear Algebra and its Applications* (third edition update) by David C. Lay (Pearson/Addison Wesley, 2006, ISBN 0-321-28713-4). This book comes with a CD containing additional information (*Study Guide*, solutions, data files, projects, etc.) you will need for this class.
- **Time/Place:** 2:00–2:50pm Monday, Wednesday, Friday in Science Center 160.
- **Attendance:** You are expected to attend class.

Assignments: The work you do outside class will play a major role in helping you learn the material for this class. Read the assigned section—and work all practice problems—before coming to class each day. After covering the material in class, work the assigned exercises, check your answers (in the back of the text and/or the *Study Guide*), and ask for help when needed. Homework will not be handed in (unless otherwise announced) but will be reviewed in class as needed. Most quiz and exam problems will be taken from the textbook examples, practice problems, and assigned exercises (possibly with minor modifications).

Projects: Several projects involving the use of MATLAB will be assigned; these projects may be completed individually or in teams as announced. No collaboration allowed between teams.

Quizzes: Quizzes may be given any day in class without prior notice. Missed quizzes will not be made up. If you miss a quiz due to an excused absence, it will be dropped from your quiz average.

Exams: There will be three hour exams, tentatively scheduled for Wednesdays 16 September, 14 October, and 11 November (in class). The final exam (week of 7 December) will cover the entire course. No grade exemptions from the final exam. If you want me to reconsider your score on an exam, you must return it to me—with a *written explanation* of your request—within three days of when the exams are returned in class.

Late Work: Projects are due when stated and will not be accepted late; missed quizzes and exams will not be made up. Exceptions may be made at my discretion in exceptional circumstances.

Grades: Your final score will be a weighted average of your scores on quizzes (10%), projects and any other work handed in (15%), three hour exams (20% each for two highest, 15% for lowest), and final exam (20%). Final scores translate into letter grades by the scale 90–100 A, 80–89 B, 70–79 C, 60–69 D, 0–59 F with *no "curve"*.

Code of Ethics: I take the Clarkson Code of Ethics seriously. Any violation will result in a score of zero on the work in question (at best) and will be reported to the Academic Integrity Committee. Cheating on an exam will result in a grade of F for the course. For more information, see the section on Academic Integrity in the Clarkson Regulations. When in doubt, ask me in advance.

Course Learning Objectives:

- To learn the fundamental concepts of linear algebra in the concrete setting of $\mathbb{R}^n$
- To learn to use linear algebra to solve problems from engineering and other fields
- To learn to use computer software to apply the techniques of linear algebra

Course Outcomes: Upon successfully completing this course you should be able to:

- perform basic matrix calculations
- set up and solve linear systems in applied problems
- identify a linear transformation and find and use its matrix representation
- explain the basic concepts of linear algebra (subspace, span, linear independence, basis, dimension)
- identify and work with these concepts in $\mathbb{R}^n$
- compute determinants of matrices
- compute eigenvalues and eigenvectors of matrices
- use eigenvalues and eigenvectors to diagonalize matrices and to solve systems of differential equations
- find an orthonormal basis for a subspace
- find least-squares solutions of linear systems
- use MATLAB to solve applied problems involving linear algebra

In order to achieve these outcomes you should expect to spend about six hours per week doing the assignments (reading and exercises) and projects, in addition to the three hours per week you spend in class.

Topical Outline:

1. Systems of Linear Equations [chapter 1]
   (a) Row reduction and echelon forms
   (b) Vector and matrix equations
   (c) Linear independence
   (d) Matrices and linear transformations
   (e) Applications of linear systems
2. Matrix Algebra [chapter 2]
   (a) Matrix operations
   (b) The inverse of a matrix
   (c) Partitioned matrices
   (d) The LU factorization
   (e) Subspaces of $\mathbb{R}^n$
   (f) Basis, dimension, and rank in $\mathbb{R}^n$
3. Determinants [chapter 3]
4. The Eigenvalue Problem [chapter 5]
   (a) Eigenvalues and eigenvectors
   (b) Diagonalization
   (c) Discrete dynamical systems
   (d) Applications to differential equations
5. Orthogonality and Least Squares [chapter 6]
   (a) Inner product, norm, and orthogonality
   (b) Orthogonal vectors and projections
   (c) The Gram-Schmidt process
   (d) Least-squares problems and applications