

SPRING SEMESTER 2005

## Math 220: Matrices Syllabus

**Course Description:** Systems of linear equations; matrix algebra; eigenvalues and eigenvectors; linear systems of differential equations.

**Prerequisite:** Math 110 or 140.

**Textbook:** *Linear Algebra and its Applications*, third edition, by David Lay, published by Addison Wesley Longman.

**Calculators:** The use of calculators will not be permitted on exams. Calculators may be used (but are not required) on homework assignments.

**Midterm:** A 75-minute evening examination will be held on March 1, 2005 at 6:30.

**Final Exam:** A comprehensive final examination, covering all the content of the course, will be given. The final exam period will begin on Monday, May 2 and will end on Friday, May 6. **Students should not make plans to leave University Park before Saturday, May 7, 2005.** Students must bring their student identification cards to all examinations.

**Conflict and Makeup Exams:** Only students with official University conflicts, or a valid, documented excuse, will be permitted to schedule the conflict exam or the makeup with no penalty. Students who miss the exams (without a documented excuse) may take a makeup, but will receive a mandatory 20-point deduction on their scores. Lab. Students must sign up for conflict or makeup exam at least 48 hours in advance of the exam date.

**Grading Policy:** Grades will be assigned on the basis of 350 points distributed as follows:

- 100 points for homework and quizzes
- 100 points for the midterm examination
- 150 points for the final examination

**Academic Integrity:** All Penn State and Eberly College of Science policies regarding academic integrity apply to this course.

See <http://www.science.psu.edu/academic/Integrity/index.html> for details.

**Course outline:**

(The number after each section is the approximate number of class periods).

I. LINEAR EQUATIONS IN LINEAR ALGEBRA

- 1.1 Systems of Linear Equations (1.5)
- 1.2 Row Reduction and Echelon Forms (1.5)
- 1.3 Vector Equations (1.5)
- 1.4 The Matrix Equation  $Ax = b$  (1)
- 1.5 Solution Sets of Linear Systems (1)
- 1.7 Linear independence (1)
- 1.8 Introduction to Linear Transformations (1)
- 1.9 The Matrix of a Linear Transformation (1.5)

II. MATRIX ALGEBRA

- 2.1 Matrix Operations (1)
- 2.2 The Inverse of a Matrix (1)
- 2.3 Characterizations of Invertible Matrices (1)
- 2.8 Linear Subspaces (1.5)
- 2.9 Dimension and Rank (1.5)

III. DETERMINANTS

- 3.1 Introduction to Determinants (0.5)
- 3.2 Properties of Determinants (1)

IV. EIGENPROBLEMS

- 5.1 Eigenvalues and Eigenvectors (2)
- 5.2 The Characteristic Equation (1)
- 5.3 Diagonalization (1)
- 5.4 Eigenvectors and Linear Transformations (1)

V. ORTHOGONALITY AND LEAST-SQUARES

- 6.1 Inner Product, Length, and Orthogonality (0.5)
- 6.2 Orthogonal Sets (1)
- 6.3 Orthogonal Projections (1)
- 6.4 The Gram-Schmidt Process (no Factorization) (1)
- 6.5 Least-Squares Problems (plus example 1 from 6.6) (1)

VI. SYMMETRIC MATRICES

- 7.1 Diagonalization of Symmetric matrices (Spectral Theorem) (1)
- 7.2 Quadratic Forms (1)