Math 220: Matrices

Syllabus

Course Description: Systems of linear equations; matrix algebra; eigenvalues and eigenvectors; orthogonality and least squares, symmetric matrices and quadratic forms.

Prerequisite: Math 110 or 140.


Instructor: Dr. Ping Xu

Office: 329 McAllister

Office hours: Tuesday 4:00 p.m.-5:00 p.m. Also by appointment.

Email: ping@math.psu.edu

Quizzes: There will be a few quizzes in this courses. Most problems in the quizzes will be similar to the homework problems. Each quiz is counted as one homework assignment.

Homework: Homework will be posted in my homepage (http://www.math.psu.edu/ping/m220.html) each week before Tuesday and collected in Tuesday’s class a week after. Homework should be handed in on time, stapled and legible. Late homework will not be graded. In each homework, only five selected problems will be graded and each problem will be worth 10 points. Homework should present your own work. Answers unsupported by work will not receive any credit. You are allowed to drop two homework assignments or quizzes.

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 Wednesday, Oct 13, 2010 at 6:30 pm. For the midterm, there is a conflict exam from 5:05 pm to 6:20 pm on the same day as the regular exam.
Final Exam: A comprehensive final examination, covering all the content of the course, will be given. The final exam period will begin on Monday, Dec. 13 and will end on Friday, Dec. 17. **Students should not make plans to leave University Park before Saturday, Dec. 18, 2010.** For the final exam, notification of conflicts is given on the student’s final exam schedule on e-lion. A student must take action to request a conflict exam through e-lion between Sept. 27 and Oct. 17. Note that the conflict final exam is scheduled by the Registrar’s office, it is not the responsibility of the Department of Mathematics. Students who miss both the regular and the conflict final examinations due to a valid and documented reason, such as illness, may be allowed to take a makeup final examination. If a student does not have a valid reason, a 30 points penalty will be imposed. All such makeup examinations must be scheduled through the instructor and students must contact the instructor within 24 hours of the final examinations.

**Conflict and Makeup Midterm Exams:** Only students with official University conflicts, or a valid, documented excuse, will be permitted to schedule the conflict midterm 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. Students must sign up for the conflict exam in class, with your instructor, on a pink form. The student is responsible for knowing the room and time of the conflict exam. This information is on the top of the pink form. Note that your instructor must turn in the pink form 48 hours prior to the examination date. If you have not signed up with your instructor, you will not be allowed to take the conflict exam. For the conflict midterm exam, no student is permitted to leave the examination room before 6:25 pm. Any student who leaves before 6:25 pm will receive a score of zero on the exam and will not be allowed to retake it. For the makeup exam, students must sign up with your instructor, on a yellow form, as soon as possible following the regular 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

Final grades will be assigned as follows:

- A 325-350
- A- 315-324
- B+ 304-314
- B 290-303
Note: (a) Note that we do not use a curve in this course.
(b) Grades will be based exclusively on the midterm, homework, and the final exam. There is no “extra-credit” work for this course.

Math Center and Tutors: Free mathematics tutoring is available at Penn State Learning (www.PennStateLearning.psu.edu) located in 7 Sparks Building. If you need additional help, you may consult the list of private tutors maintained by the undergraduate office. Students are expected to pay for their tutoring session. The Private Tutor List is available through the homepage of the Undergraduate Program of the Department of Mathematics at http://www.math.psu.edu/ug/. This website is also a good source of general information about undergraduate mathematics as well as information on evening exam schedules, office hours of instructors etc.

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.

Questions, problems, or comments: If you have questions or concerns about a grade or a course-related issue, please consult your instructor first. For complaints about teaching, the student should contact Dr. J. Sellers (sellersj@math.psu.edu).
Course outline (tentative):
(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 (1)
   3.2 Properties of Determinants (1)

IV. EIGENPROBLEMS
   5.1 Eigenvalues and Eigenvectors (2)
   5.2 The Characteristic Equation (1)
   5.3 Diagonalization (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 QR 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)