MATH 6112 Advanced Linear Algebra

Fall 2013

MW 3:00-4:30

Professor Federico Bonetto

Office Hours: MW 4:30-5:30, classroom;

The argument covered will include:

- Review of Vector Spaces, Matrices and Canonical Form.
- Schur decomposition, SVD, and their consequences.
- Positive (Nonnegative) Matrices: Perron Frobenius Theory
- Matrices depending on parameters

I'll use the notes by prof. Dieci.

The syllabus can be found here.

There will be two midterm.

I will assign HW for collection collection every other week. The HW will be taken from the notes.

The final grade will be based on the following rules: 45% final, 35% midterms, 20% HW. Curving will be done on the final result.

First week

Material covered:

- (1.2) Field
- (1.3) Vector Space
- (1.4) Eigenvalues and Eigenvectors
- (1.5) Matrices and canonical forms

Advanced Linear Algebra

Department: MATH
Course Number: 6112
Hours - Lecture: 3
Hours - Lab: 0
Hours - Recitation: 0
Hours - Total Credit: 3
Typical Scheduling: Every fall
Description:
An advanced course in Linear Algebra and applications.
Prerequisites:

Undergraduate linear algebra at the level of Math 4305, and ability to write rigorous proofs at the level of Math 2406.

Course Text:
Material will be selected from the following books, and supplemented by classnotes as needed. Books: "Matrix Analysis" and Analysis" by Horn & Johnson, "Advanced Linear Algebra" by Roman, "Linear Algebra and its applications" by Lax.
Topic Outline:

[Items 1)-5) to be covered every time. These may take between 50% and 75% of the time. The remaining portion of time sho selected topics according to the instructor's interests; see 6) below.]

1. Characteristic and minimal polynomial. Eigenvalues, field of values.
2. Similarity transformations: Diagonalization and Jordan forms over arbitrary fields. Schur form and spectral theorem fo Quadratic forms and Hermitian matrices: variational characterization of the eigenvalues, inertia theorems.
3. Singular value decomposition, generalized inverse, projections, and applications.
4. Positive matrices, Perron-Frobenius theorem. Markov chains and stochastic matrices. M-matrices.
5. Structured matrices (Toeplitz, Hankel, Hessenberg). Matrices and optimization (e.g., linear complementarity problem
6. Other topics and applications depending on the interest of the instructor. Examples are Krylov subspaces, tensor and integer matrices, Schur complement, matrix equations and inequalities, polar factorization and proper orthogonal dec algorithms, applications to signal and image processing, matrices depending on parameters, eigenvalues and singula functions of matrices, etc.