DMA-SAP-431 APPLIED LINEAR ALGEBRA

SEMESTER: Spring

CREDITS: 6 ECTS (4 hrs. per week)

LANGUAGE: English

DEGREES: SAPIENS program

Course overview

This is a foundation course in linear algebra. By its nature, linear algebra has many applications in abstract mathematics and in real life. We will present theoretical concepts with their motivation and applications.

The class time will be devoted to lectures where the students should gain an understanding of basic concepts and methods, realize connections between various parts of linear algebra and eventually build a global picture of linear algebra. The material we cover is also meant as an introduction to a more abstract level of learning or using mathematics.

Prerequisites

Basic knowledge of Calculus and Algebra.

Course contents and methodology

Methodology

Lecture, solving calculation problems during exercises.

Contents

1. LINEAR SYSTEMS (Chapters 1 and 6 in [1]).

    Matrices, Vectors and Gauss-Jordan elimination. On the solutions of Linear Systems. Matrix Algebra. Determinants.

2. VECTOR SPACES (Chapters 3 and 4 in [1]).

    Vector Spaces and Subspaces. Linear Independence, Basis and Dimension. Coordinates.

3. LINEAR TRANSFORMATIONS (Chapters 3 and 4 in [1]).

    Linear Transformations and Isomorphisms. The Matrix of a Linear Transformation.

4. EIGENVALUES AND EIGENVECTORS (Chapter 7 in [1]).

   Dynamical Systems and Eigenvectors: An introductory example. Diagonalization of a Matrix. Complex Matrices.

5. ORTHOGONALITY (Chapter 5 in [1]).

   Orthogonal Vectors and Subspaces. Projections and Least Squares. Orthogonal Bases and Gram-Schmidt.

6. POSITIVE DEFINITE MATRICES (Chapter 8 in [1]).

   Minima, Maxima and Saddle Points. Quadratic Forms. Singular Value Decomposition.

Textbooks

[1] *Linear Algebra with Applications,* 4th Edition, Otto Bretscher. (basic bibliography)

[2] *Introduction to Linear Algebra*, 4th Edition, Gilbert Strang. (additional bibliography)

Grading

The overall grade will be obtained as follows:

- Three midterms (15%, 25% and 35% respectively)
- Homework (25%)

The students whose grades are less than 5 or those who want to improve their previous grades will do a final exam the last day of the course. Their final grade will be the maximum between the grade obtained in this final exam and the result of computing 70% of the final exam and 30% of the homework.

The students who fail the course will have the chance to do an extraordinary exam. The grade obtained in this exam will be their definitive grade.

The exams are all closed notebook and closed textbook. The course will not be graded on a curve, i.e., there is no bound on the numbers A's, B's, C's, etc.