SYLLABUS DEL CORSO

Algebra Lineare e Geometria

1920-1-E3501Q051

Aims

In line with the educational objectives of the Degree in Mathematics, the course aims to provide an introduction to linear algebra with applications to geometry, essential to prepare the student to understand the mathematics that will be taught in other courses.

Students are expected to gain knowledge of fundamental notions on vector spaces, diagonalization of endomorphisms and scalar products. They are also expected to gain the ability to reproduce the proofs presented in the course, to solve easy problems using the techniques they have learned, and to delve further, with or without guidance, into some of the results presented during the course.

Contents

Vector spaces; systems of linear equations and affine geometry. Linear maps, matrices; diagonalization of an endomorphism. Scalar products.

Detailed program

- Matrix calculus.

- Systems of linear equations.

- Affine subspaces of R^n and their representations. Distance and orthogonality in R^n

- Vector spaces.

- Linear maps and matrices.

- Determinants.

- Eigenvalues, eigenvectors, characteristic polynomial, diagonalization.
- Dual space.

- Scalar and Hermitian products; Sylvester Theorem.

- Self-adjoint, orthogonal, unitary operators.
- Spectral Theorem.

Prerequisites

A good knowledge of mathematics studied in higher school.

Teaching form

Lectures: 48 hours (6 CFU) in which definitions, results and relevant theorems will be presented, providing examples and problems making use of the notions introduced.

Exercise classes: 24 hours (2 CFU) in which exercises related to the subject matters presented in the lectures are presented and solved. In order to encourage student participation, some exercises are left for the students to solve.

A tutor will aid the students in solving the exercises published on the e-learning website every week.

Textbook and teaching resource

Reference book:

- S. Lang, Algebra Lineare, Boringhieri, III edizione.

Other resources:

- M. Abate, Geometria, McGraw Hill, 2002.

Lecture notes on e-learning webpage.

Semester

First semester.

Assessment method

Written and/or oral exam

The written exam consists of two parts:

a. exercises (with open-ended questions) which allow the teachers to evaluate the student's ability to apply the theory in solving problems;

b. a theoretical question where the student is asked to give complete definitions, statements of theorems and/or provide examples and motivations.

The examination lasts two hours. The total score (33 points) is divided into 27 points for the exercises and 6 points for the theoretical part. The test is evaluated in terms of correctness. completeness, accuracy and clarity of the solutions.

Oral exam.

Students are admitted to the oral test only if the written exam's score is at least 15 points. This test consists in a first part given by the discussion of the written test and in a second part consisting in the verification by the teachers of knowledge and mastery of definitions, theorems and proofs in the program.   Both parts are taken into account in forming the final mark, which is the average of the written and oral exam's scores. ──────────────

Due to the health emergency, there will be no exemption from the oral test for students who take the written test in June, July or September 2020.

Exemption from the oral test.

Students passing the written test with a mark in the range 21-25, with at least 3 points in the theoretical part, are exempted from the oral test, the final mark being equal to the mark obtained in the written test, rounded down. If the score of the written test is greater than 25 it is still possible to be exempted from the oral test, however the final mark in this case will be 25/30.

Exemption from the written test.

In the middle and at the end of the course there will be two *midterm written exams,* passing both midterms allows

students to be admitted to the oral test. The assessment criterion is the same as the one outlined above. Access to the oral test is granted with _____

Office hours

By appointment.