SYLLABUS DEL CORSO

Matematica III

1920-2-E2701Q063

Aims

The objectives of the course are the following.

Knowledge and understanding. The student will learn the principal results of multi-variable integral calculus, vector calculus and linear algebra and will become acquainted with their tools and techniques.

Applying knowledge and understanding. By means of several examples and exercises, the student will develop the ability of applying the theorical results presented in the lectures to problems of integration in several variables, vector calculus and linear algebra.

Making judgements. The student will be able to face critically problems of integration in several variables, vector calculus and linear algebra, identifying by himself/herself the most appropriate tools among those introduced in the course.

Communication skills. The student will become familiar with the introduced language and mathematical formalism, which will make him/her able to communicate with rigor and clarity the acquired knowledge.

Learning skills. The student will be able to apply the acquired knowledge to different contexts, in particular in the study of other scientific disciplines (such as chemistry and physics) which require a good mathematical background.

Contents

Integral calculus in several variables, vector calculus, linear algebra.

Detailed program

1. **Double integrals.** Double integrals over rectangles, iterated integrals, double integrals over general regions, change of variables in double integrals, double integrals in polar coordinates.

2. **Surface integrals.** Surfaces in $\mathbf{R}^3$, parametrization of a surface, regular surfaces, normal vector, orientation of a surface, surface integrals, flux of a vector field across a surface.

3. **Triple integrals.** Triple integrals over boxes, iterated integrals, change of variables in triple integrals, triple integrals in cylindrical and spherical coordinates.

4. **Vector calculus.** Green's Theorem, Stokes' Theorem, Divergence Theorem.

5. **Linear Algebra.** Real and complex vector spaces, dependent and independent sets in a linear space, subspaces. Bases and dimension of a linear space, euclidean spaces, norms and (Hertmitian) inner products, Cauchy-Schwarz inequality, orthogonality. Orthonormal bases. Linear transformations: matrix representation, null space and range, nullity and rank, matrices, matrix operations, determinants, Binet formula, Laplace expansion; inverses of square matrices, change of the bases. Eigenvalues and eigenvectors of endomorphisms, diagonalizability. Adjoint endomorphism, hermitian operators, Spectral Theorem, simultaneous diagonalization.

Prerequisites

First year math courses.

Teaching form

Lessons (6 CFU), exercise classes (2 CFU).

Textbook and teaching resource

- J. Stewart, Calcolo. Funzioni di più variabili, Apogeo.

- M. Abate, Algebra lineare, McGraw-Hill.

- *Appunti di Algebra Lineare per il corso di Matematica III*, lecture notes written by the teacher and available on the e-learning site.

Semester

First semester.

Assessment method

The exam consists of a written test, aimed at verifying the level of knowledge, the ability to apply it to the resolution of exercises, the student's independence in making judgements, as well as his/her communication skills. The test is divided into two parts: the first part contains theoretical questions while the second part contains exercises. The final grade depends for 1/3 on the first part of the test and for 2/3 on the second part.

During the year there are 6 exam sessions in the following periods: one in February, one in April/May, one in June, one in July, one in September and one in November. The final exam can be replaced by two intermediate written tests, the first of which will take place in November while the second one will take place at the end of the course.

Office hours

By appointment scheduled through email (veronica.felli@unimib.it).