UNIVERSITÀ DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Metodi Matematici per L'analisi Economica – Ottimizzazione e Analisi Convessa

2021-1-F4001Q095

Aims

In line with the educational objectives of the Master Degree in Mathematics, the course aims at providing the *knowledge* about the fundamental concepts and statements of the theory of optimization and convex analysis in the Euclidean setting. It will also build the *skills* needed to understand and use the most important proving arguments and techniques in the theory and the *ability* to solve exercises and deal with problems exploiting them. Particular emphasis will be put on the theory of nonlinear programming and its relationship with convexity, as well as some results of duality.

Contents

Finite-dimensional optimization, elements of convex analysis, duality theory, introduction to game theory

Detailed program

Introduction to optimization problems. Basic calculus tools in R^n.

Unconstrained optimization.

Ekeland variational principle.

Transposition theorems.

Convex analysis for sets and functions.

Nonlinear programming.

Duality theory and convex programming.

Strategic games.

Nash equilibrium.

Two-players zero-sum games.

Mixed strategies in finite games.

Prerequisites

Basic concepts and results of linear algebra and analysis in finite-dimensional spaces.

Teaching form

The lectures will be held in the lecture hall with blackboard.

During the Covid-19 emergency situation, lectures will be recorded (no streaming) and made available to the students on the e-learning page of the course.

If required by the students or judged advantageous by the professor, there may take place events in live streaming, possibly attended by small groups of students.

The teaching hours will be dedicated either to the illustration of the main results in the theory, or to the solution of exercises of applications of the theory.

Textbook and teaching resource

O. Guler, Foundations of Optimization, Springer, 2010

S. Boyd and L. Vandenberghe, Convex Optimization, Cambridge University Press, 2009 https://web.stanford.edu/~boyd/cvxbook/

J. Gonzalez-Diaz, I. Garcia-Jurado and M.G. Fiestras-Janeiro, An Introductory Course on Mathematical Game Theory, American Mathematical Society

Semester

II

Assessment method

Examination type:

Written and oral examination.

a) The written part consists of exercises where the students show their ability in using methods and tools introduced in the course (80%), as well as questions (20%). If the mark of the written exam is between 18/30 and 26/30, then the final grade is the grade of the written exam. If the grade of the written part is greater than or equal to 27/30, the student obtains at most 27/30 as final grade unless he/she decides to undergo the oral part.

b) The oral part consists of statements and proofs of theorems from a detailed list, as well as theorical exercises. It is only for students with mark not less than 27/30 in written examination. Its relative weight is 25%. It consists in:

- discussion about the written part;
- the student must show his competence about subjects considered in the lectures (i.e., statements and proofs of theorems from a detailed list, theorical exercises)

Office hours

By appointment.

During the Covid-19 emergency period the consultation hours will be carried out using the WebEx platform.