



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Matematica per la Finanza - 1

2425-2-E1803M051-T1

Learning objectives

- To be able to express oneself using the formal language of mathematics
- Understand and be able to repeat simple proofs
- Be able to apply the theoretical concepts studied to simple exercises, similar to those carried out in class
- Be able to use Excel for simple financial calculations.

Contents

- Series
- Integrals
- Linear algebra
- Linear programming
- Financial mathematics
- Bonds
- Introduction to derivatives

Detailed program

- 1) Successions and series
 - definition of series: character and sum
 - necessary condition for convergence
 - geometric series, telescopic series, harmonic series
 - series with nonnegative terms: convergence criteria
 - series with terms of alternate sign: Leibniz criterion

2) Integrals

- definition of Riemann integral and first properties
- theorems on integrals
- calculation of primitives: integration by parts, by substitution, integration of rational functions.
- Improper integrals and convergence criteria

3) Linear algebra

- vectors, vector spaces
- matrices, linear functions
- operations with matrices
- determinant, rank, inverse matrix
- linear systems: Rouché-Capelli theorem
- Gauss method

4) Linear Programming.

- Formalisation of L.P. problems and examples
- Geometric solution

5) Traditional Financial Mathematics

- Elementary financial operations: principal, interest, discount
- Capitalisation laws and discounting laws
- Interest rates and discount rates. Equivalent rates. Force of interest. Severability.
- Annuities and their classification. Calculation of present values.
- Amortisation schedules
- NPV and IRR

6) Bonds

- interest rate risk and duration
- calculation and properties of duration
- calculation of duration in Excel
- geometric meaning of duration
- intuitive idea of immunisation
- convexity

7) Introduction to derivatives

- Generalities on derivatives: options, forwards, futures
- Payoffs of elementary positions in options, Merton constraints
- First applications of the non-arbitrage principle
- The binomial one-period and two-period model, valuation of European and American options
- Introduction to the Black-Scholes formula

Prerequisites

The course Matematica Generale is a prerequisite for Matematica per la Finanza.

In general terms, the concepts of theorem, hypothesis, thesis, proof, necessary condition and sufficient condition will be fundamental.

More particularly, we will use elementary functions (powers, roots, exponentials, logarithms, trigonometric functions), the concept of limit, the concept of asymptotic, the concept of derivative and the methods for calculating derivatives.

Teaching methods

The course is divided into 56 hours of lectures and 24 hours of exercises.

Both lectures and exercises are conducted in person. The lecture hours are primarily dedicated to explaining concepts, while the exercise hours focus on applying these concepts to specific examples.

Lecture slides are made available to students before the lesson. Those who are unable to attend a lesson can study the materials independently, and if something is unclear, they can ask questions in dedicated forums on the e-learning page. Each question receives a response from the instructor.

Interactive Teaching.

Lessons are conducted in groups of two or three consecutive hours. In the three-hour lesson, a variable amount of time between 15 and 45 minutes is dedicated to interactive activities such as:

- i) discussing problems assigned at home in previous lessons
- ii) implementing formulas or concepts seen during the lesson in Excel using a bring your own device approach
- iii) examples of using the Bloomberg terminal

Assessment methods

The examination consists of a written exam with open-ended questions in which both knowledge and understanding of the topics explained in the lecture and the ability to apply them to simple problems similar to those carried out in tutorials will be assessed. The written paper is followed by an optional oral examination.

Textbooks and Reading Materials

- Lectures' Slides

For further reading:

- "Successioni, serie e integrali", Manuale modulare di Metodi Matematici, vol. 5, a cura di Giovanna Carcano, edizioni Giappichelli Torino

- "Algebra lineare", Manuale modulare di Metodi Matematici, vol. 4, a cura di Maria Ida Bertocchi, edizioni Giappichelli Torino

- "Elementi di Matematica Finanziaria e cenni di Programmazione Lineare", S. Stefani, A. Torriero e G. Zambruno, edizioni Giappichelli Torino

- "Opzioni e futures", J. Hull

Semester

First Semester

Teaching language

Italian

Sustainable Development Goals
