



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Financial Mathematics - 1

2324-2-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 theoretical concepts will be explained through slides made available to the students. The course will be accompanied by hours of exercises in which the concepts explained will be applied to the solution of simple problems.

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

