UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Matematica per la Finanza - 1

2122-2-E1803M051-T1

Learning objectives

- Being able of using a formalized mathematical language
- Understanding and being able to repeat simple mathematical arguments
- Being able to do simple mathematical calculations, similar to those discussed during the lectures
- Being able to use Excel for simple financial calculations

Contents

- Series
- Integrals
- Linear Algebra
- Linear Programming
- Financial Mathematics
- Bonds
- Introduction to derivative instruments

Detailed program

1) Sequences and series
 - Convergent, divergent and oscillating series
 - Necessary condition for convergence
 - Geometric series, harmonic series, telescopic sums
 - Sufficient conditions for convergence
 - Leibniz criterion

 2) Integrals

- Construction of the Riemann integral and first properties
- Theorems on integrals
- Computations of integrals: integration by parts and by substitution. Integration of rational functions.
- Improper integrals
- Sufficient conditions for convergence of improper integrals

3) Linear algebra
- Vectors, vector spaces
- Matrices, linear functions
- Operations with matrices
- Determinant, Rank, Inverse matrix
- Linear systems and Rouché-Capelli Theorem
- Gauss algorithm

4) Linear programming
- Examples of linear problems
- Geometric solution

5) Financial mathematics
- Elementary definitions of financial mathematics
- Interest rates. Force of interest.
- Annuities and their net present values
- Time indexes
- Amortizing plans
- Choice between financial operations
- Net Present Value and Internal Rate of Return
- Term structure of interest rates

6) Bond mathematics
- Interest rate risk and duration
- Properties of duration
- Duration in Excel
- Geometric interpretation of duration
- Convexity
- Immunization
- Term structure

7) Introduction to derivative instruments
- Options, forward, futures
- Marking to market
- Elementary payoffs, Merton bounds
- No arbitrage principle
- Binomial model in one and two periods
- Black-Scholes formula
- Sensitivity analysis: computation of Delta and Gamma

Prerequisites

It is necessary to have passed the exam of Matematica Generale.

Teaching methods

All lectures will be recorded. Approximately 80% of the lectures will be in asynchronous mode, while the remaining 20% of the lectures and the exrecise classes will be in synchronous mode.

Assessment methods

Esame scritto con orale facoltativo.

Textbooks and Reading Materials

- Slides and recorded lessons

- “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