



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Finanza Matematica M

2425-2-F8204B024

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#### Learning objectives

The aim of the course is to introduce students to continuous time financial models and the necessary mathematical tools.

#### Contents

Continuous time stochastic processes and applications to financial modeling

#### Detailed program

1. Probability essentials: probability spaces, properties of the expected value, construction of the conditional expected value;
2. Finite variation processes: definition and properties. The stochastic integral with respect to a finite variation process;
3. Martingales: definition and main properties. Brownian motion and its properties. The quadratic variation of a martingale;
4. Ito integral: the elementary stochastic integral; Ito extension theorem; properties of the stochastic integral with respect to a martingale;
5. Ito's Lemma and exponential martingale: Ito's expansion and its use in the solution of some stochastic differential equations;
6. Tanaka's formula and change of measure: integration by parts formula and the change in process characteristics arising from a change of the underlying probability;
7. Black & Scholes: main structural characteristics; Black & Scholes PDE; the equivalent martingale measure approach

8. Fundamental Theorem of Asset Pricing: the existence of risk neutral measures and their application to asset pricing;
9. Stochastic volatility models: stochastic components of volatility and market completeness; Hull and White model; Heston model..

## **Prerequisites**

Probability, statistics and mathematical methods.

## **Teaching methods**

Lectures (42 hours) and classes (on-line)

## **Assessment methods**

Written exam with exercises aiming at verifying the knowledge of the mathematical tools as well as of some simple financial models in continuous time.

## **Textbooks and Reading Materials**

S. Shreve, Stochastic Calculus for Finance, Springer, 2004.

Lecture Notes

## **Semester**

First semester

## **Teaching language**

Italian (English)

## **Sustainable Development Goals**

QUALITY EDUCATION

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