# Quantitative Methods for Finance I

## Prof. Paola Biffi

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The aim of the course is to present the quantitative foundations of finance and provide students with the basic techniques that they can immediately put into operation. The course will propose the formal and translatable into practical rules principles that regulate financial markets; also introducing the most important financial instruments for operating on the market and controlling risk.

Mathematics provides suitable forms of calculus for making it possible to establish equity rules for loans and capital accumulation plans and, above all, to price bonds. These equity rules make it possible to quantify the trend of interest rates (by means of a no-arbitrage principle).

The course analyses how time and markets contribute to creating uncertainty; deterministic control instruments are supplied for debt securities, while stochastic control instruments are supplied for equity securities.

By the end of the course, students will be able to:

– understand and apply the basic mathematical-financial tools used to solve economic and financial problems;

– analyse and use these techniques to formalise the problems and their solutions;

– evaluate and comment on the results obtained by adopting a mathematical notation and an appropriate technical language.

***COURSE CONTENT***

1*. The time value of money:* capital accumulation and loan amortisation.

Instruments are presented to show how timing influences financial transactions, thereby demonstrating how flexibility makes it possible to follow highly volatile market trends.

*2. Methods for valuing financial investment projects and financing:* quantitative decision theory; consistency of valuation criteria in conditions of certainty; present value; implicit rate of return.

Summary instruments will be proposed for the valuation and critical selection of business projects, respecting the characteristics thereof.

3. *Bonds:* zero coupon bonds and coupon bonds.

The student learns to price debt securities and to analyse the financial characteristics of such securities, particularly with regard to interest rates dynamic.

*4. The no arbitrage principle*

The relationships of equilibrium for financial products will be described within a context of an assumed perfect market.

*5. Financial risk:* Equity and risk: introduction to portfolio selection theory. Presentation of classical instruments for measuring risk and valuing equity investments portfolios.

***READING LIST***

Text adopted

P. Mazzoleni, *Metodi quantitativi per la finanza I,* EDUCatt, 2009.

Recommended reading

F. Cesari, *Introduzione alla Finanza Matematica: concetti di base,* *tassi e obbligazioni; mercati azionari, rischi e portafogli,* McGraw-Hill, 2012.

G. Longo-C. Battaglio-L. Peccati, *Matematica per le applicazioni finanziarie,* Etas Libri, 1994.

***TEACHING METHOD***

Classroom lectures and practical exercises.

***ASSESSMENT METHOD AND CRITERIA***

Written test with exercises and theoretical questions. The rigor of the application of the formulas and models analyzed will be assessed, in addition, an adequate ability to support and comment, with language properties, the results obtained is required. The theoretical questions allows student to demonstrate his knowledge in formalising and explaining economic and financial problems.

***NOTES AND PREREQUISITES***

Special prerequisites for the course are the knowledge of some basic concepts of algebra and differential calculus for functions with one real variable.

In case the current Covid-19 health emergency does not allow frontal teaching, remote teaching will be carried out following procedures that will be promptly notified to students.

Further information can be found on the lecturer's webpage at http://docenti.unicatt.it/web/searchByName.do?language=ENG or on the Faculty notice board.