**Derivatives Instruments (Finance and Finance – Corporate advisory)**

## Prof. Giovanni Petrella

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

The course provides students with the skills required in three main areas: option pricing of different underlying assets (shares, stock market indexes, currencies, futures), pricing of interest-rate derivatives (bond options, caps, floors, swaptions) and credit derivatives pricing. The course includes practical exercises aimed at the application of the concepts studied in the theoretical lectures. At the end of the course, students will be able to know and understand the assumptions, as well as to apply the main models that are generally used for derivative assessment.

***COURSE CONTENT***

Educational objectives that students are expected to achieve during the course

1. *Stock options.*

At the end of this part of the course, students will be able to:

– Understand the stochastic trend of stock prices.

\* Estimate the expected future price of a stock.

– Apply the Black-Scholes-Merton model for the evaluation of European stock options (with or without dividends).

– Use the Black model to approximate the value of an American call option on stock.

2. *Options on equity indexes, currencies, and futures.*

At the end of this part of the course, students will be able to:

– Use options on equity indexes to contain the risk of loss in a portfolio.

– Evaluate the European options on equity indexes.

– Evaluate the European options on currencies.

– Evaluate the European options on futures by using binomial trees.

– Evaluate the European options on futures by using the Black model.

3. *Greek letters.*

At the end of this part of the course, students will be able to:

– Understand the delta hedging mechanism.

– Understand and estimate the delta, gamma, theta, rho, vega.

4. *Volatility smile.*

At the end of this part of the course, students will be able to:

– Understand how the traders use the Black-Scholes model in order to extracts volatility singnals.

– Understand how traders use the volatility smile in pricing.

5. *Numerical procedures.*

At the end of this part of the course, students will be able to:

– Understand the functioning of the Monte Carlo simulation.

– Perform simple Monte Carlo simulations.

6. *Estimating expected volatility*.

At the end of this part of the course, students will be able to:

– Estimate the volatility based on the rolling standard deviation of historical returns.

– Understand autoregressive models to forecast volatility.

7. *Exotic options.*

At the end of this part of the course, students will:

– know the different types of exotic options.

– be able to apply the numerical procedures to valuate some types of exotic options.

8. *Energy derivatives.*

At the end of this part of the course, students will:

– know the main derivatives written on energy.

– know the patterns for commodity prices.

***READING LIST***

J.C. Hull, *Opzioni,* *futures e altri derivati*, Pearson, Milano, (chapters 14, 15, 17, 18, 19, 20, 21, 25, 26, 29, 31, 35), 2021, 11th edition.

Supplementary material (slides, additional documentation, etc.) will be made available to students on the Blackboard platform.

***TEACHING METHOD***

Frontal lectures (70% of the course) and practical exercises (30%).

***ASSESSMENT METHOD AND CRITERIA***

As regards the assessment methods, the examination of students’ competence will be based on a written test, which generally consists of three open questions structured in sub-questions.

As regards the assessment criteria, there will be a partial grade given to each answer. The final grade will be an average of the partial grades. There is no oral exam planned.

Written test, usually consisting of 4 questions and lasting 60 to 90 minutes. The questions refer to concepts, examples, and models covered in the course and may require solving numerical exercises.

***NOTES AND PREREQUISITES***

*Prerequisites*

Educational objectives that students are expected to have achieved before attending the course:

– a basic knowledge of futures, options, and swaps.

– a basic knowledge of inferential statistics.

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.