Name	Quantitative Finance and Asset Management
Component modules	-
Scientific-disciplinary sector	ECON-09/B
Year of course and semester of provision	2nd year, 1st semester
Language of instruction	English
Didactic load in university formative credits	7
Number of hours of total assisted teaching activities divided between DD and ID	Delivered Didactic: 42 Interactive Didactic: 7
Teachers	Raffaele Didonato
Specific learning outcomes	The educational objective of the course is to provide the student with knowledge of the main quantitative models used in finance for measuring and managing risks, as well as creating financial value. Specifically, the student will gain knowledge of the main statistical inference tools that allow to build multi-factor models together with the main multi-factor model definition as well as derivatives and option pricing models. By the end of the course, the student will be capable of understanding the key characteristics that distinguish different tools required for quantitative modeling and their application for the analysis of financial markets. Upon completion of the course, the student will be able to apply the acquired knowledge to specific analytical situations and evaluate trends in the financial markets and financial data evaluations using the main techniques used in professional practice. At the end of the study program, the student will have acquired the ability to make qualitative and quantitative analysis on a portfolio of assets as well as provide judgments on the key investment metrics used for portfolio evaluations. By the end of the course, the student will be able to effectively and clearly articulate the knowledge acquired on the topic of analysing financial data (specifically for listed entities), building linear models, measuring and understanding the risks underlying financial market investments.
Program	• Introduction to Quantitative Finance • Statistical portfolio analysis: - Measures of variability, dispersion, and central tendency - Volatility measurements in a portfolio - Variables dependency and portfolio diversification • Elements of probability and their application to investment analysis: - Random variables and probability distribution - Conditional probability - Expected returns of a portfolio - Lognormal distribution in the stock market • Portfolio performance calculations and analysis: - Measures of portfolio performance - Time Value of Money - Future Value, Present Value and Internal Rate of Return

	• Forecast models and risk measurement: - Linear regression for portfolio analysis - Assets correlation - Risk and volatility measures • Utility theory for decision-making: - Risk-neutral and risk-averse utility functions - Expected utility maximisation • Risk and Return relationship and Mean Variance Analysis: - How to define and interpret risk measures - Risk Return Trade-off - Mean-Variance analysis • Asset Pricing Models and Risk-Adjusted Performance Measures - Arbitrage Pricing Theory - Capital Asset Pricing Model - Definition of Multi-factor Models - Fama-French three factors model, Carhart four factors model, Fama-French five factors model. - Risk measures and risk-adjusted performance measures • Derivatives - Main definitions - Derivatives use cases - Investment strategies and asset allocation using derivatives • Options and Option pricing models - Binomial pricing model - Risk-neutral Evaluation - Black-Scholes-Merton Model - The Greeks • Asset Allocation Strategies and Asset Liability Management - Asset allocation strategies and factors - The case for ESG and impact investing - Asset-Liability Management and Matching - The importance of ALM in financial institutions (SVB case)
Types of didactic activities envisaged and relative methods of carrying out	• Practice sessions and programming exercises with software (R and Excel); • Case studies; • Mock exams with multiple choice questions and essay questions.
Learning evaluation methods and criteria	The examination is conducted in written form. The test, to be taken on the scheduled date (after online booking), consists of 25 multiple-choice questions and 2 essay questions and has a duration of approximately 75 minutes. The multiple-choice questions encompass both theoretical and practical aspects and are designed to assess the level of knowledge and understanding of the tools and methodologies required for data analysis and modelling in the context of quantitative finance. The essay questions are aimed at evaluating the ability to articulate the knowledge gained and apply it to real-life use cases .
Criteria for measuring learning and assigning the final grade	The assessment of learning will provide a grade expressed on a scale out of thirty. The grade is assigned based on the following criteria: up to 21 points are awarded through 25 multiple-choice questions, and up to 10 points are awarded through 2 essay questions.

Prerequisites	
Didactic material used and recommended didactic material	• John C. Hull, (2021) Options, Futures, and Other Derivatives. Peason, 11th edition. • Di Ciaccio, S. Borra (2004) "Statistica. Metodologie per le Scienze Economiche e Sociali". McGraw-Hill, Milano • Sharpe, W. (1964) Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk, The Journal of Finance, Vol.19, No. 3, pp. 425-442; • Treynor, J. (1961) Toward a Theory of the Market of Risky Assets; • Lintner, J. (1965) The Valuation of Risk Assets and the Selection of the Risky Investments in Stock Portfolios and Capital Budgets, The Review of Economics and Statistics, pp. 13-37. • Mossin, J. (1966) Equilibrium in a Capital Asset Market, Econometrica, pp. 768-783; • Black, F. (1972) Capital Market Equilibrium with Restricted Borrowing, The Journal of Business, Vol. 45, No. 3, pp. 444-455 • Ross, S. (1976) The Arbitrage Theory of Capital Asset Pricing, Journal of Economic Theory 13, pp. 343-362; • Fama, E., French, K. (1996) Multifactor Explanations of Assets Pricing Anomalies, The Journal of Finance, Vol. 51, No. 1; (1999) Value versus Growth: International Evidence, The Journal of Finance; • Carhart, M. M. (1997) On Persistence in Mutual Fund Performance, The Journal of Finance, Vol 52, No. 1, pp. 57–82 • Fama, E., French, K. (2004), The Capital Asset Pricing Model: Theory and Evidence Journal of Economic Perspectives, Vol. 18, No. 3, pp. 25–46 • https://www.r-project.org/