Syllabus

Course Description

Course Title	Mathematics of Finance
Course Code	27331
Course Title Additional	
Scientific-Disciplinary Sector	SECS-S/06
Language	English
Degree Course	Bachelor in Economics and Management
Other Degree Courses (Loaned)	
Lecturers	dr. Silvia Bressan, Silvia.Bressan@unibz.it https://www.unibz.it/en/faculties/economics-management/academic-staff/person/37763
Teaching Assistant	
Semester	First semester
Course Year/s	2
CP	6
Teaching Hours	36
Lab Hours	18
Individual Study Hours	-
Planned Office Hours	
Contents Summary	The course deals with: Mathematics of time value of money and interest rates: Students will explore the relationship between time and the value of money. Mathematics of bond investments: Students will learn the main features and mathematical foundations of government and corporate bonds. Mathematics of risk and return: Students will be introduced to the risk/reward trade- off of financial assets, focusing on equity

	instruments.
Course Topics	Mathematics of time value of money: Students will explore the relationship between time and the value of money. Key concepts include interest rates, discounting and compounding of cash flows, present value and future value of single sums, annuities, perpetuities, and debt retirement methods. Mathematics of bond investments: Students will learn the main features and the mathematical foundations of government and corporate bonds. Key concepts include bond evaluation and pricing, determination of yield rates and rates of return, and the measurement of interest rate risk. Hints to green bonds. Mathematics of risk and return: Students will be introduced to the risk/reward trade-off of financial assets, focusing on equity instruments. Students will learn tools to analyse both historical asset returns and expected returns.
Keywords	Interest rate, discounting/compounding of cash flows, annuities, debt retirement, corporate bonds, government bonds, bond pricing, bond yield to maturity, forward rates, term structure of interest rates, bond duration, bond convexity, corporate equity, holding period return, log-return, expected return, risk of corporate equity, volatility, tail risk.
Recommended Prerequisites	No prerequisites, however it is advisable that the students have basic prior knowledge in statistics as well as in calculus and linear algebra.
Propaedeutic Courses	
Teaching Format	Frontal lectures and frontal exercise sessions. Exercises will be solved using a standard calculator. Few examples will also be presented using Excel/R. Knowledge on the use of Excel/R is not a prerequisite and is not covered by the final assessment.
Mandatory Attendance	Attendance not compulsory but strongly recommended
Specific Educational Objectives and Learning Outcomes	Knowledge and understanding Area: quantitative methods for decision-making knowledge of basic and intermediate level mathematical tools for understanding and analysing economic mechanisms through theoretical models and empirical applications knowledge of the tools for static, dynamic, and comparative

	analysis of data on individuals, firms and economies knowledge and understanding of descriptive statistics, the fundamentals of probability theory and sample methods, standard distributions and their application to economic analysis as well as linear and non-linear regression understanding of parametric estimation and hypothesis testing Knowledge of computer tools necessary for reading and analysing economic data and models knowledge of the structure of computer networks, their main applications and security techniques as well as techniques for data collection, presentation and analysis using appropriate software knowledge of international accounting systems and the double-entry method for the recognition and measurement of business operations "understanding of financial statements " "in-depth knowledge of accounting data recognition or management control " Knowledge of the analysis method for estimating present values and discount factors for estimating the cost of capital and valuation of bonds and shares Knowledge of medium and long-term financial forecasting methodologies and sensitivity analysis with simulation under uncertainty to manage risks in corporate and international finance knowledge and understanding of the international financial environment, multinational risk defence techniques and competitive strategies adopted by global banks knowledge of the mechanisms underlying effective communication of quantitative topics in three languages: Italian, German and English "Ability to apply knowledge and understanding " Area: quantitative methods for decision-making to be able to analyse (unconstrained) optimisation problems and to mathematically interpret models of social and economic dynamics to formalise economic problems using mathematical models, to solve such problems and to interpret the results conceptually being able to analyse economic data using descriptive statics,

	parametric and non-parametric methods as well as linear and non-linear regression and interpret the results knowing how to apply international accounting standards to the various contexts of business reality knowing how to derive and interpret economic information taken from the web knowing how to use computers and computer networks to analyse large quantities of data in solving complex problems and to write theses and articles knowing how to evaluate fixed-income and equity financial instruments of companies listed on stock markets through the use of spreadsheet programs knowing how to analyse financial statements by means of balance sheet ratios and communicate the results in accordance with international professional standards knowing how to apply the main theories on capital, foreign exchange and commodity markets to actually observed data, including in an international context knowing how to set up and carry out an empirical project using econometric software and financial or economic databases knowing how to use techniques for evaluating the performance of financial investments and understanding the price formation mechanisms of risky financial assets and spot and forward interest rates knowing how to work with basic and intermediate level mathematical tools, and basic level statistics, to study the behaviour of economic actors, from a theoretical and empirical point of view knowing how to analyse economic datasets using spreadsheets or other suitable software knowing how to use computer tools for the analysis of economies being able to communicate the results of quantitative analyses prepared according to international professional standards in three languages: Italian, German and English Autonomy of judgement to choose the most appropriate quantitative and qualitative methods of analysis find the necessary information in databases, legal sources and scientific literature

	use logical reasoning to combine information and analytical methods, including modern software packages, to arrive at a solution
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	Written exam for attending and non-attending students with theoretical review questions and numerical exercises.
Evaluation Criteria	Final mark from exam assessment (100%). Relevant for exam assessment: Theoretical knowledge of the concepts covered in class and ability to solve financial problems.
Required Readings	Lecture slides and notes with exercises provided by the lecturer. The content of the materials is based on the following textbooks: - Jonathan Berk, and P. DeMarzo, “Corporate Finance”, 4th edition, Pearson, 2017. ISBN: 9780134083278; - Zvi Bodie, Z., A. Kane, and A. Marcus, “Investments”, 13th Edition, 2024. ISBN: 9781264412662; - Raymond Brooks, “Financial Management: Core Concepts”, 4th Edition, Pearson, 2019. ISBN: 9780134730417; - Frank J. Fabozzi, “Capital Markets: Institutions, Instruments, and Risk Management”, 5th Edition 2015, ISBN: 978-0-262-02948-3; - Gary C. Guthrie, and L. D. Lemon, “Mathematics of Interest Rates and Finance”, New International Edition, Pearson, 2014. ISBN: 9780130461827.
Supplementary Readings	
Further Information	
Sustainable Development Goals (SDGs)	Affordable and clean energy, Responsible consumption and production, Industry, innovation and infrastructure