Syllabus
2021 - 2022

TECHNICAL SHEET OF THE SUBJECT

Data of the subject	
Subject name	Mathematics applied to financial instruments.
Subject code	E000007063
Mainprogram	Bachelor's Degree in Business Administration and Management
Involved programs	Grado en Administración y Dirección de Empresas (E-2) [Tercer Curso] Grado en Administración y Dirección de Empresas con Mención en Internacional (E-4) [Tercer Curso] Grado en Administración y Dirección de Empresas (E-2) - Bilingüe en inglés [Tercer Curso]
Credits	6,0 ECTS
Type	Optativa (Grado)
Department	Departamento de Métodos Cuantitativos

Teacher Information

Teacher

Name	Susana Carabias López
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SPECIFIC DATA OF THE SUBJECT

Contextualization of the subject

Contribution to the professional profile of the degree

The subject is designed to provide the student with the knowledge and the resources to understand the mathematical formalization of financial models, which will help them to apply and interpret them correctly. It should be useful for developing professional activities in the financial area. It will have special relevance for those who develop technical work.

Prerequisites

Commonly used financial laws.

Basic knowledge of loans and bonds.

Competencies - Objectives

Competences

GENERALES

CG01	Capacidad de análisis y síntesis

	RA1	Capacidad para expresarse en lenguaje matemático
	RA2	Capacidad de utilización de las matemáticas en otras materias de Grado
CG02	Resolución de problemas y toma de decisiones	
	RA1	Capacidad para la formulación en lenguaje matemático de los problemas que surgen en la gestión empresarial y de la resolución de los mismos
CG04	Capacidad de gestionar información proveniente de fuentes diversas	
	RA1	Capacidad de búsqueda y selección de bibliografía adecuada y otras fuentes para documentarse sobre un contenido concreto
CG14	Capacidad para aprender y trabajar autónomamente	
	RA1	Lee, sintetiza y comprende críticamente materiales bibliográficos de referencia
	RA2	Desarrolla habilidades necesarias para el estudio e investigación independiente
ESPECÍFICAS		
CE08	Conocimiento de técnicas matemáticas que permiten modelizar y resolver problemas en el ámbito económico-empresarial	
	RA2	Conoce los instrumentos matemáticos necesarios para la modelización
	RA8	Conoce el principio de comparación como origen de la formación de precios de mercado
	RA9	Conoce las variables y funciones más relevantes en la valoración de mercados de renta fija
CE09	Comprensión y correcta aplicación de los modelos matemáticos dinámicos y de valoración financiera	
	RA1	Conoce y sabe aplicar los conceptos de ley financiera y equivalencia financiera

THEMATIC BLOCKS AND CONTENTS

Contents - Thematic Blocks
BLOCK 1: THE SETTING FOR FINANCIAL MARKETS MODELS
Topic 1: BASIC PRINCIPLES OF FINANCIAL MARKET MODELLING
1.1. Models of Financial Markets. Building blocks 1.2. Typical financial problems
Topic 2: A DISCRETE ONE-PERIOD MODEL

2.1. Elements and basic assumptions. The no-arbitrage assumption

2.2. Single-period binomial model for a stock and a riskless asset

2.3. Derivative assets. Forwards and options

BLOCK 2: TYPES OF FINANCIAL SECURITIES

Topic 3: FIXED-INCOME SECURITIES

3.1. Fixed interest rate. Coupon bonds and zero-coupon bonds

3.2. Interest rate risk

3.3. Term structure of interest rates

Topic 4: STOCK MARKETS

4.1. Risk and return of a portfolio in a single-period model

4.2. The Capital Asset Pricing Model. Economic interpretations

Topic 5: DERIVATIVE SECURITIES

5.1. Forwards and Futures contracts

5.2. Financial Options

TEACHING METHODOLOGY

General methodological aspects of the subject

In-class Methodology: Activities

Theoretical class: The teacher will explain the concepts and models in order to facilitate understanding.

The student must actively participate in the classes. They must ask all the questions that have arisen after the review of the previous session.

Practical class: In each session we will discuss the exercises that the student worked out at home and we wil present new probems to be solved in class.

The work must be submitted upon teacher's request .

Students are expected to actively participate in the practical sessions with an adequate knowedge of the material, which will contribute to the student's overall score on the subject

Presentations: The students, in pairs, will make an presentation in the classroom, which will consist of presenting the correction of a practice, previously reviewed by the teacher, or in the explanation of a theoretical topic, after a preparation supported in the bibliography and tutored by the teacher.

Non-Presential Methodology: Activities

Preparation for the theoretical class: The student could be required to read some material before the class. These readings prepare the students for an active participation in the sessions, which will contribute to the student's overall score on the subject.

Work on the theoretical classes: At the end of each class, the student are supposed to figure out what they have learned and supplement it with the provided material. The student who does not achieve an optimum performance in the master class will be expected to talk to their teacher in order to identify the sources of their problem.

Preparation for the practical class: The student is expected to solve the exercises that the teacher will indicate before each practical class.

The exercises and practices will be given to the teacher at the beginning of the class, but it will be the student's responsibility to correct them in the practical class. After that, the students can prepare a corrected version, in case they found mistakes in the delivered one.

This collection of work is gathered to build a portfolio which will contribute to the student's overall score on the subject.

Preparation for the presentations: The preparation will have three stages. In the first stage, students face the problem and make a first approach to the resolution.They should then go to a tutoring with the teacher who will review this first approach and guide them for the preparation of materials. After tutoring, students will finish preparing their presentation.

SUMMARY STUDENT WORKING HOURS

CLASSROOM HOURS
NON-PRESENTIAL HOURS
ECTS CREDITS: 6,0 (0 hours)

EVALUATION AND CRITERIA

Evaluation activities	Evaluation criteria	Weight
Final exam	• To understand concepts • To properly formalize concepts and relationships • To properly apply these concepts to solve the problems related to financial securities	50
Midterm	• To understand concepts • To properly formalize concepts and relationships • To properly apply these concepts to solve the problems related to financial securities	10
Presentations	• To show understanding of the concepts • The preparation is sufficient and appropriate • Clarity of the presentation	10

Portfolio	• To deliver the tasks on time • To develop concepts and conclusions by using a language that is consistent with what is required • To identify mistakes from the correction during the class and deliver a corrected second version	20
Active class participation	• To correctly perform the required work • To actively participate in class activity	10

Ratings

If the final examination score exceeds the portfolio score, the weight of the examination would increase in 15% and the portfolio would be 5%.

If the final examination score exceeds the midterm score, the weight of the examination would increase in 5% and the midterm would be 5%.

These are the weights that each activity/skill will receive in the student's overall course score that we will apply to students that are enrolled for the first time. Students with 'dispensa de escolaridad' or students who will take the final exam on 'tercera convocatoria' or higher will receive the highest between the final exam score and the score determined as for the students enrolled for the first time (the latter will ONLY be applied to the activities that the student will decide to undertake).

WORK PLAN AND SCHEDULE

Activities	Date of realization	Delivery date
Presentation in the classroom of the correction of a practice or in the explanation of a theoretical topic	week 1 to 12	week 2 to 13

BIBLIOGRAPHY AND RESOURCES

Basic Bibliography

TEXTBOOK:

Carabias, S. (2016) Introducción a la modelización de mercados financieros. Prácticas de matemáticas para finanzas. Universidad Pontificia Comillas, Madrid.

Complementary Bibliography

TEXTBOOKS:

Capiński, M. y Zastawniak, T. (2011) *Mathematics for Finance. An Introduction to Financial Engineering*, Springer Undergraduate

Mathematics Series, Springer-Verlag, London.

Cvitanic, J. y Zapatero, F. (2004) *Introduction to the Economics and Mathematics of Financial Markets*, MIT Press, Cambridge, MA.

Koch Medina, P y Merino, S. (2003) *Mathematical Finance and Probability. A Discrete Introduction*, Birkhäuser Verlag, Basel,

La Grandville, O. (2001) *Bond Pricing and Portfolio Analysis: Protecting Investors in the Long Run*, MIT Press, Cambridge, MA.

Luenberger, D.G. (1998) *Investment Science*, Oxford University Press, New York.

WEB SITES:

Banco de España: http://www.bde.es/

Tesoro Público: http://www.tesoro.es/

Banco Central Europeo http://www. ecb.int/stats/money/yc/html/index.en.html

Euribor http://www.euribor.org/