



## TECHNICAL SHEET OF THE SUBJECT

Data of the subject	
Subject name	Mathematics applied to financial instruments.
Subject code	E000007063
Main program	<a href="#">Bachelor's Degree in Business Administration and Management</a>
Involved programs	Grado en Administración y Dirección de Empresas (E-2) [Third year]
Credits	6,0 ECTS
Type	Optional
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
<b>Contribution to the professional profile of the degree</b>
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.
<b>Prerequisites</b>
Commonly used financial laws. Basic knowledge of loans and bonds.

Competencies - Objectives		
<b>Competences</b>		
<b>GENERALES</b>		
CG01	Capacidad de análisis y síntesis	
	RA1	Capacidad para expresarse en lenguaje matemático



	<b>RA2</b>	Capacidad de utilización de las matemáticas en otras materias de Grado
<b>CG02</b>		Resolución de problemas y toma de decisiones
	<b>RA1</b>	Capacidad para la formulación en lenguaje matemático de los problemas que surgen en la gestión empresarial y de la resolución de los mismos
<b>CG04</b>		Capacidad de gestionar información proveniente de fuentes diversas
	<b>RA1</b>	Capacidad de búsqueda y selección de bibliografía adecuada y otras fuentes para documentarse sobre un contenido concreto
<b>CG14</b>		Capacidad para aprender y trabajar autónomamente
	<b>RA1</b>	Lee, sintetiza y comprende críticamente materiales bibliográficos de referencia
	<b>RA2</b>	Desarrolla habilidades necesarias para el estudio e investigación independiente
<b>ESPECÍFICAS</b>		
<b>CE08</b>		Conocimiento de técnicas matemáticas que permiten modelizar y resolver problemas en el ámbito económico-empresarial
	<b>RA2</b>	Conoce los instrumentos matemáticos necesarios para la modelización
	<b>RA8</b>	Conoce el principio de comparación como origen de la formación de precios de mercado
	<b>RA9</b>	Conoce las variables y funciones más relevantes en la valoración de mercados de renta fija
<b>CE09</b>		Comprensión y correcta aplicación de los modelos matemáticos dinámicos y de valoración financiera
	<b>RA1</b>	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 will present new problems 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 knowledge 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 an assignment, 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 submitted in Moodle within the stipulated period. 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 submitted one.

These assignments are gathered to build a student portfolio which will contribute to the student's overall grade 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	<ul style="list-style-type: none"><li>To understand concepts</li><li>To properly formalize concepts and relationships</li><li>To properly apply these concepts to solve the problems related to financial securities</li></ul>	50
Midterm	<ul style="list-style-type: none"><li>To understand concepts</li><li>To properly formalize concepts and relationships</li><li>To properly apply these concepts to solve the problems related to financial securities</li></ul>	10



Presentations	<ul style="list-style-type: none"><li>To show understanding of the concepts</li><li>The preparation is sufficient and appropriate</li><li>Clarity of the presentation</li></ul>	10
Portfolio	<ul style="list-style-type: none"><li>To deliver the tasks on time</li><li>To develop concepts and conclusions by using a language that is consistent with what is required</li><li>To identify mistakes from the correction during the class and deliver a corrected second version</li></ul>	20
Active class participation	<ul style="list-style-type: none"><li>To correctly perform the required work</li><li>To actively participate in class activity</li></ul>	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.



# COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

ICADE

CIHS

**Syllabus**  
**2022 - 2023**

## 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/>

In compliance with current regulations on the **protection of personal data**, we would like to inform you that you may consult the aspects related to privacy and data that you have accepted on your registration form by entering this website and clicking on "download"

<https://servicios.upcomillas.es/sedelectronica/inicio.aspx?csv=02E4557CAA66F4A81663AD10CED66792>