Syllabus
2024 - 2025

TECHNICAL SHEET OF THE SUBJECT

Data of the subject	
Subject name	Mathematics applied to financial instruments.
Subject code	E000012999
Level	Reglada Grado Europeo
Quarter	Semestral
Credits	6,0 ECTS
Type	Optativa (Grado)
Department	Departamento de Métodos Cuantitativos
Coordinator	Susana Carabias López

Teacher Information

Teacher

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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.

Competencies - Objectives

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. Duration of 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 pr session.

Practical class: In each session we will discuss the exercises that the student worked out at home and we wil present new probems 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 cont 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 assignment, previously reviewed by the teacher, or in the explanation of a theoretical topic, after a preparation supported 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 prepa 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 learne supplement it with the provided material. The student who does not achieve an optimum performance in the master class v 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 pr class.

The exercises and practices will be submitted in Moodle wthin the stipulated period. It will be the student's responsibility to correct 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 approach to the resolution.They should then go to a tutoring with the teacher who will review this first approach and guide them f preparation of materials. After tutoring, students will finish preparing their presentation.

EVALUATION AND CRITERIA

Final exam and midterm, which will assess the following learning achievements:

- To understand concepts
- To properly formalize concepts and relationships
- To properly apply these concepts to solve the problems related to financial securities

Presentations, with the following assessment criteria:

- To show understanding of the concepts
- The preparation is sufficient and appropriate
- Clarity of the presentation

Portfolio, with the following assessment criteria:

- 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

Active involvement/Class participation, which includes assessment of preparatory work.

Ratings

Grade will be the result of an average of the different activities, with the weights described below:

The weight the final exam will ranges from 50% to 70%. The most favourable weight to the student will be chosen.

The weight of midterm will ranges from 5% to 20%. The most favourable weight to the student will be chosen.

The weight of the portfolio will range from 5% to 20%. The most favourable weight to the student will be chosen.

The weight of presentations will be 10%.

Theweight of active involvement will be 10%.

These weights are applicable to students who enrolled for the first time (i.e. first call, en su primera convocatoria).
For students in their second or higher call (tercera convocatoria o superiores), or students with attendance waiver (dispensa de escolaridad), the course score will be the maximum between the final exam score and the score describe beforehand for students first-time enrolled.

Any action of the student aimed at increasing his qualification in a fraudulent way will imply that the corresponding activity has a grade of zero, in addition to the disciplinary consequences that may entail.

Any document or source of information from which an idea is obtained for the preparation of a work must be correctly cited, so that it is not interpreted as a fraudulent action. Following APA's directions, personal communications, whether with humans or machines, that cannot be retrieved or reproduced by another will not be included in the reference list, but will be cited only in the text, with the appropriate format. For example: (ChatGPT, personal communication, December 12, 2022).

BIBLIOGRAPHY AND RESOURCES

Basic Bibliography

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/