Course guide
200223 - MF - Financial Mathematics

Last modified: 01/06/2023

Unit in charge: School of Mathematics and Statistics
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: BACHELOR'S DEGREE IN MATHEMATICS (Syllabus 2009). (Optional subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: JOSEP JOAQUIM MASDEMONT SOLER

Others: Segon quadrimestre:
JOSEP JOAQUIM MASDEMONT SOLER - M-A
FRANCESC D'ASSIS PLANAS VILANOVA - M-A

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
3. CE-2. Solve problems in Mathematics, through basic calculation skills, taking in account tools availability and the constraints of time and resources.
4. CE-4. Have the ability to use computational tools as an aid to mathematical processes.
5. Ability to solve problems from academic, technical, financial and social fields through mathematical methods.

Generical:
1. CB-4. Have the ability to communicate their conclusions, and the knowledge and rationale underpinning these to specialist and non-specialist audiences clearly and unambiguously.
2. To have developed those learning skills necessary to undertake further interdisciplinary studies with a high degree of autonomy in scientific disciplines in which Mathematics have a significant role.
6. CG-1. Show knowledge and proficiency in the use of mathematical language.
7. CG-2. Construct rigorous proofs of some classical theorems in a variety of fields of Mathematics.
8. CG-3. Have the ability to define new mathematical objects in terms of others already know and ability to use these objects in different contexts.
9. CG-4. Translate into mathematical terms problems stated in non-mathematical language, and take advantage of this translation to solve them.
10. CG-6 Detect deficiencies in their own knowledge and pass them through critical reflection and choice of the best action to extend this knowledge.

Transversal:
11. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
12. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.

TEACHING METHODOLOGY

(Section not available)

LEARNING OBJECTIVES OF THE SUBJECT

The aim of this course is to introduce students to mathematical methods for evaluating modern financial products. The course is composed of three parts: the first one is devoted to describing fiancial products and their evaluation using arbitrage, the second one provides the mathematical foundations for discrete processes, and finally the third part is devoted to continuous processes and concludes with an introduction to the Black-Scholes model.

STUDY LOAD

Type	Hours	Percentage
Hours small group	30,0	20.00
Hours large group	30,0	20.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

Financial Products and arbitrage

Description:
Introduction to futures and options. The concept of arbitrage and its use. Hedging with futures and options. Forward and future prices. Futures on interest rates. Swaps. Price properties of option prices on shares.

Discrete Models

Description:
The binomial tree model. The risk-neutral probability. Formalism for discrete markets. Information, measurability and filtrations. Portfolio strategy and self financing. Conditional expectation. Kolmogorov's theorem. Martingales.

Continuous Models

Description:
Random walk and opening towards continuous markets. Brownian motion. Itô's integral and calculus. Stochastic differential equations. Measure change theorems. Continuous self-financing strategies. The Black-Scholes model and formula.

GRADING SYSTEM

There will be a partial exam, that will not carry exemption for the final exam. The final mark will be obtained by means of max(0.4x (partial exam)+ 0.6 x (final exam), final exam).

BIBLIOGRAPHY

Basic:
- Baxter, M.; Rennie, A. Financial calculus : an introduction to derivative pricing. Cambridge [etc.]: Cambridge University Press, 1996. ISBN 0521552893.
- Dotham, N. Prices in financial markets. New York (N.Y.) [etc.]: Oxford University Press, 1990. ISBN 0195053125.
- Hull, John C. Options, futures and other derivatives. 8th ed. Prentice Hall, 2011. ISBN 9780132777421.
- Wilmott, Paul. Paul Wilmott introduces quantitative finance [on line]. Chichester [etc.]: John Willey & Sons, 2001 [Consultation: 28/06/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=309819.
- Lamberton, D; Lapeyre, B. Introduction to stochastic calculus applied to finance. 2a ed. London [etc.]: Chapman and Hall, 2008. ISBN 9781584886266.

Complementary:
- Ikeda, N; Watanabe, S. Stochastic differential equations and diffusion processes. 2nd ed. Amsterdam ; New York: North Holland,

1989. ISBN 0444873783.
- Williams, David. Probability with martingales. Cambridge [etc.]: Cambridge University Press, 2000. ISBN 0521406056.
- Rogers, L.C.G.; Williams, D. Diffusions, Markov processes, and martingales. 2nd ed. Cambridge: Cambridge University Press, cop. 2000. ISBN 0521775949.
- Wilmott, P.; Howison, S.; Dewyne, J. The Mathematics of financial derivatives : a student introduction. Cambridge: Cambridge University Press, 2007. ISBN 0521497892.