FACULTAD DE CIENCIAS
ECONÓMICAS Y EMPRESARIALES

**SYLLABUS**
**COURSE 2017-18**

## SYLLABUS OF THE SUBJECT

| Information about the subject | |
|---|---|
| Nombre | Financial Mathematics |
| Titulación | Degree in Business Administration |
| Curso | Second |
| Cuatrimestre | Fall |
| Créditos ECTS | 5 |
| Carácter | Mandatory |
| Departamento | Quantitative Methods |
| Coordinador | Susana Carabias López |

| Information – Faculty members | |
|---|---|
| **Coordinator** | |
| Nombre | Susana Carabias López |
| Departamento | Quantitative Methods |
| Despacho | OD-228 |
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| **Professor** | |
| Nombre | Mirco Soffritti |
| Departamento | Quantitative Methods |
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## SPECIFIC INFORMATION ABOUT THE SUBJECT

| Context |
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| **Contribution to the professional profile of the student** |
| The subject is designed to provide students with the knowledge and the resources that are needed to analyze and compare financial operations that are held in an environment characterized by certainty, as well as the foundations to solve problems associated with many kinds of financial transactions. |
| **Prerequisites** |
| Mathematics at high school level. |

## TOPICS AND CONTENT

| Content - Topics |
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| **Group 1: FUNDAMENTAL ELEMENTS OF FINANCIAL MATHEMATICS** |
| **Topic 1: FINANCIAL CAPITALS AND FINANCIAL OPERATIONS** |
| **1.1** Financial capital: definition and unit of measure<br>**1.2** Financial operations: definition<br>**1.3** Financial operations: classification |
| **Topic 2: FINANCIAL LAWS** |
| **2.1** Financial law as a criteria to project financial capitals<br>**2.2** Commonly used laws of accumulation<br>**2.3** Commonly used laws of discount |
| **Topic 3: FINANCIAL EQUILIBRIUM** |
| **3.1** The equation of financial equivalence<br>**3.2** The financial equilibrium of a financial operation<br>**3.3** Income and effective rates. The rules of the Spanish Central Bank: TAE<br>**3.4** Outstanding balance. Definition and calculation methods |
| **Group 2: FINANCIAL OPERATIONS IN THE SHORT RUN AND LONG RUN** |
| **Topic 4: VALUATION OF ANNUITIES** |
| **4.1** Annuities: definition and classification<br>**4.2** The value of constant annuities<br>**4.3** The value of variable annuities<br>**4.4** Application to financial decisions. NPV and IRR |
| **Topic 5: PRIVATE LOANS** |
| **5.1** Concept and general overview<br>**5.2** Classical amortization methods<br>**5.3** Mortgage loans |
| **Topic 6: PUBLIC AND CORPORATE DEBTS** |
| **6.1** Definition and classification<br>**6.2** Private promissory notes and their discount<br>**6.3** Public promissory notes (Treasury Bills)<br>**6.4** Public debt |
| **Group 3: INTRODUCTION TO MARKET VALUATION** |
| **Topic 7: OPERATIONS WITHIN "FIXED INCOME" MARKETS** |
| **7.1** The market value of a loan<br>**7.2** The term structure of interest rates (TTIR) |

| Skills - Objetives |
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| **General skills required by the subject** |
| **Instrumental skills** |
| • Application of analytical and quantitative terms to solve problems<br>• Information management |
| **Systemic skills** |
| • Autonomy in learning process |

| Specific skills required by the subject |
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| **Conceptual skills** |
| • To learn the models of financial operations in a risk-free setup and in discrete time<br>• To analyze and compare theoretical and real financial operations.<br>• To understand the concept of market valuation. |
| **Procedural skills** |
| • To interpret the information provided by institutions operating in the Spanish financial markets<br>• To know and know how to manage the basic bibliography on Financial Mathematics. |
| **Attitudinal skills** |
| To assess the utility and universality of a number of mathematic models; with a limited number of basic concepts we will be able to analyze a multitude of different financial operations. |

## TEACHING METHODOLOGY

| General methodological aspects of the subject | |
|---|---|
| **In-classroom Methodology: Activities** | **Skills** |
| **Magisterial class:** The teacher will explain the subject's basic concepts as well as the relations between them, with emphasis on the fact that the same principles can be applied to study a wide range of financial operations. The material explained in each class will be based on the material taught in the previous ones; for this reason, to obtain the best results it is key to deeply assimilate previously learnt concepts. In addition, the student is recommended to bring to each class the material that corresponds to it. | • To know the mathematical models of certain financial operations in discrete time.<br>• To understand the concept of market valuation |
| **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. Quizzes will be administered as independent activities. The work may be submitted upon teacher's request at the end of a class. 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 | • To analyze and compare financial operations, both theoretical and real.<br>• To apply analytical and quantitative methods to solve problems. |
| **Midterm exams:** depending of the topic, midterm exams they will have different formats and be more or less comprehensive; they will be designed to assess the student's understanding of the subject | • To know the mathematical models for specific financial operations in discrete time.<br>• To understand the concept of market valuation.<br>• To analyze and compare financial operations, both theoretical and real. |
| **Out-of-classroom Methodology: Activities** | **Skills** |
| **To prepare for the magisterial class:** At the end of each class the students 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. | • To assess the utility and universality of the mathematical models to analyze and compare financial operations, both theoretical and real. |
| **To prepare for the practical class:** The student is expected to solve the exercises that the teacher will indicate before each practical class.<br>**To prepare for the midterm exams:** At the end of each topic, the student is expected to review all the concepts that they have learned and | • To achieve autonomy in learning.<br>• To be able to use analytical and quantitative tools to solve a problem.<br>• To know the mathematical models for a number of financial operations in discrete time. |

| | |
|---|---|
| understand the relationships that exist between them and with the concepts learned in previous topics. When the student receives a graded test they should critically analyze their mistakes and talk to the professor in case the score does not correspond with their expectations. | • To analyze and compare actual and theoretical financial operations |
| **Assignment I:** once having made a group of three, the students are expected to select an actual loan and analyze it. They are expected to submit two reports, one at the beginning of the course and another at the end, by so reflecting their understanding progress.<br><br>**Assignment II:** once having made a group of three, the students are expected to compare the presentation of a key concept of financial mathematics done in the basic bibliography with another source of their choice. Then, they are expected to produce a report based on this comparison. | • To learn how to well manage information<br>• To interpret the information that institutions provide on financial operations<br>• To achieve autonomous learning<br>• To know and know how to manage basic bibliography on Financial Mathematics |

## EVALUATION AND GRADING CRITERIA

| ITEMS OF EVALUATION | CRITERIA | WEIGHT |
|---|---|---|
| **Tests for all groups in each specialty** | - To understands concepts;<br>- To properly apply these concepts to solve the problems that relate to financial operations | 70% |
| **Continuous evaluation exams** | - To understands concepts;<br>- To properly apply these concepts to solve the problems that relate to financial operations | 12% |
| **Assignment I** | - To identify quality information<br>- To identify the relevant information for a given problem<br>- To correctly interpret the information provided by a financial institution<br>- To correctly apply the concepts related to specific loans | 8% |
| **Assignment II** | - To perform the required bibliographical search<br>- To learn how to quote and reference properly<br>- To develop concepts and conclusions by using a language that is consistent with what is required | 4% |
| **Active class participation** | - To correctly perform the required work<br>- To actively participate in class activity | 6% |
| The percentages described will apply to all the various testing periods. For students with approved waivers, the grade will be based only on the final exam score, if such score is more favorable than the average one. | | |

## OUTLINE OF THE STUDENT'S WORKING SCHEDULE

| In-classroom *versus* out-of-classroom activities | Date of completion | Date of submission |
|---|---|---|
| **Assignment I. Report I** | W1 and W2 | W2 |
| **Assignment II** | Optional between W2 and W5 | Optional between W3 and W6 |
| **Assignment I. Report II** | W12 and W13 | W13 |

| OUTLINE OF THE STUDENT'S WORKING HOURS | | |
|---|---|---|
| **IN CLASS** | | |
| **Magistral class** | **Practical class** | **Valuation** |
| 28 | 21,5 | 5 |
| **OUT OF CLASS** | | |
| **Autonomous work on theoretical content** | **Autonomous work on specific content** | **Collaborative activities** |
| 25 | 15 | 10 |
| | **CREDITS ECTS:** | **5** |

## BIBLIOGRAPHY AND READING RESOURCES

**Basic reference**

**Textbooks**

- Stephen G. Kellison, *The Theory of Interest*, 3 ed, McGraw Hill, University of Central Florida. ∇
- Bonilla Musoles, Ivars Escortell, & Ismael Moya CL 2006, *Matemática de las operaciones financieras: teoría y práctica,* Thomson, Madrid. ⊗
- Pablo López, AN 2002, *Valoración financiera,* Centro de Estudios Ramón Areces, Madrid. ⊗

**Web sites**

Central Bank of Spain: http://www.bde.es/

Treasure: http://www.tesoro.es/

**Additional material**

Outlines, problems, follow-up tests, PowerPoint slides of class material, additional material posted on the school's web site for the subject.

**Additional bibliography and reading resources**

**Books**

- Gil Peláez, LO, Baquero, MJ, Gil, MA & Maestro, ML 1991, *Matemática de las operaciones financieras: problemas resueltos,* AC, Madrid. ⊗
- Pablo López, 2000, *Manual práctico de matemática comercial y financiera,* Centro de Estudios Ramón Areces, Madrid. ⊗
- Pablo López, 2003, *Matemática de las operaciones financieras I*, UNED, Madrid. ⊗
- Petr Zima, Robert L. Brown, 2011, *Mathematics of Finance*, Second Ed., Schaum's Outline Series, McGraw Hill ∇
- Marek Capiński, Tomasz Zastawniak, 2011, *Mathematics for Finance*, *An Introduction to Financial Engineering*, Second Ed., Springer-Verlag Ed. ∇

⊗ = in Spanish ; ∇= in English