Financial Mathematics

Lecturer: François Belot & Moulka Tamzali-Lafond
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Department: LSO
Semester: 1 and 2

Course level: L3 Undergraduate
Domain: Business (finance & quantitative methods)
Teaching language: English
Number of in-class hours: 27
Number of course sessions: 10
ECTS: 3

Course description and objectives

This course aims to provide a conceptual framework that enables economic agents (households, entrepreneurs, bankers, investors, etc.) to analyze and make informed decisions when faced with problems involving multiple financial flows (expenses and/or revenues) distributed over time.
Key concepts such as the time value of money, compounding, discounting, future and present value, and the yield rate will be introduced and applied to the financial decision-making process regarding savings, investment, and borrowing.
The course is structured around five main chapters:

1. Interest, Compounding, and Discounting
2. Analysis of Cash Flow Sequences
3. Individual Loans
4. Investment Decisions
5. Analysis of Bond Loans

Throughout the course, students will complete in-class exercises and home assignments to reinforce the material covered.

Prerequisites

A good understanding of the fundamental concepts of algebra is required to take this course, and in particular the following concepts: exponential functions, logarithms, power functions, arithmetic and geometric sequences.

Learning outcomes

By the end of this module, students will be able to:

1. Know the methodology of financial mathematics and its importance in comparison – evaluation of financial products.
2. Manipulate mathematical and numerical models used to price financial securities and to make risk estimates
3. Conceptualise the different types of financial mathematics solutions that exist predominantly in dealing with loans and investments.
4. Use mathematical formulas to run simulated scenarios and critically justify financial decisions based on these simulations.
5. Appraise investable projects and decide on project feasibility for any company.
6. Understand standard financial instruments (bonds and stocks)
7. Understand bond pricing, performance, and risk

Assignments and grading

- 50% Written Midterm Exam
- 50% Final Exam

Attendance
Attendance is mandatory. Students are expected to attend all classes, arrive on time, and stay for the entire session. Repeated absences or lateness may affect the final grade.

Class Participation
Active participation is encouraged, as it contributes to making classes more engaging and instructive. Students are expected to come prepared and contribute thoughtfully to discussions. When participation is part of the course assessment, it is evaluated based on the quality of contributions rather than their quantity.

Exam Policy
Students are not allowed to bring any materials into exams, except those explicitly authorized by the instructor. Unexcused absences from exams or failure to submit assigned cases will result in a grade of zero when calculating final averages. All exams must be submitted at the end of the examination period.

Communication and Grading
All questions or concerns regarding grading or course policies must follow the official procedures. No direct negotiation with instructors about grades or assessments is permitted.

Course structure

Session	Topic
1	**Introduction – Interest rates, compounding and discounting (Chapter 1)**
2	**Cash flow sequences (Chapter 2)**
3	***Exercises on chapter 1 and chapter 2***
4	**Individual Loans (Chapter 3)**
5	***Exercises on chapter 3***
6	**Investments (Chapter 4)**
7	***Exercises on chapter 4***
8	**Bonds (Chapter 5)**
9	***Exercises on chapter 5***
10	**Final Exam**

1. Interest, Compounding, and Discounting
a) The time value of money
b) Simple interest
c) Compounding and compound interest
d) Equivalent and proportional rates
e) Present value and discounting
f) Summary and synthesis

2. Analysis of Cash Flow Sequences
a) Analytical framework
b) Mathematical review
c) Future and present value: the general case
d) Constant annuities
e) Geometrically increasing annuities
f) Arithmetically increasing annuities
g) Internal yield rate

3. Individual Loans
a) Analytical framework
b) Principles of loan amortization
c) Repayment through constant annuities
d) Repayment through constant principal
e) Bullet (lump-sum) repayment
f) Geometrically increasing annuities
g) Extensions and special cases
h) The effective cost of a loan

4. Investment Decisions
a) Analytical framework
b) Net Present Value (NPV)
c) Internal Rate of Return (IRR)
d) Payback period
e) Comparing multiple projects
f) Combined evaluation criteria
g) Conclusion

5. Analysis of Bond Loans
a) Main characteristics of bonds
b) Bond valuation
c) Introduction to bond risk management: duration and sensitivity

Bibliography

The following classic finance textbooks (also recommended in other undergraduate and graduate finance courses) include chapters that cover the key mechanisms explored in this course:

- *Corporate Finance: Theory and Practice*, Pierre Vernimmen, Pascal Quiry, and Yann Le Fur, Wiley, 2022, 6th edition.
- *Corporate Finance*, Jonathan Berk and Peter DeMarzo, Pearson, 2023 (6th edition).
- *Capital Market Finance: An Introduction to Primitive Assets, Derivatives, Portfolio Management and Risk*, Roland Portait and Patrice Poncet, Springer, 2022.

Lecturer's biography

François Belot is Professor of Corporate Finance at Université Paris-Dauphine and a member of the DRM-Finance research team. He works in the areas of corporate governance, with a focus on boards of directors, employee involvement in governance, separation of ownership and control and forms of shareholding, in particular family control. He currently heads the academic Master program "Insurance and risk management" (Master 218).

Moulka Tamzali-Lafond is an academic coordinator and lecturer within MIDO, Mathematics Department at Université Paris-Dauphine, specializing in Algebra, Linear Algebra and Financial Mathematics.

Moodle

This course is on Moodle: **Yes**
Slides, exercises sheets and on-line quizzes are available on Moodle

Academic integrity

Be aware of the rules in Université Paris Dauphine about plagiarism and cheating during exams. All work turned in for this course must be your own work, or that of your own group. Working as part of a group implies that you are an active participant and fully contributed to the output produced by that group.