GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Financial Mathematics (F000804)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 2)	Dutch	Gent	lecture
			seminar

Lecturers in academic year 2024-2025

Devos, Arnaud	TW07	lecturer-in-charge

Offered in the following programmes in 2024-2025	**crdts**	**offering**
Bachelor of Science in Economics	6	A
Bachelor of Science in Mathematics	6	A
Master of Science in Mathematics	6	A

Teaching languages

Dutch

Keywords

Annuities, endowments, amortisations of debts, bonds, life insurance

Position of the course

Financial mathematics develops and studies deterministic mathematical models describing transfer and investment of capital. This course gives an introduction to the theory of financial mathematics, the so-called financial algebra.
This course contains also an elementary treatment of the fundamentals of life-insurance which makes part of actuarial mathematics.
Special attention is paid to the use of a pocket calculator in the practical part of this course.
Throughout this course the analytic way of thinking is further developed as well as a problem-solving attitude. The skill of communicating solutions based on scientific knowledge is also trained.

Contents

- simple interest and simple discount
- compound interest
- equation of equivalence and equation of value
- annuities and perpetuities
- amortisations of debts and sinking funds
- bonds
- life-annuities and life-insurance

Initial competences

The student can understand and use mathematical language. The student has a thorough theoretical and practical knowledge of algebra and of real analysis of functions of several variables. and of convergence of sequences and series In particular, of integration calculus, the student can solve equations, can use exponential and logaritmic functions and apply their properties.
The student can analyse a problem and develop a mathematical model, using mathematical knowledge and competences.
The student has pratical knowledge of interest, current and saving accounts.

Final competences

1
- Compute simple and compound interest rates.
- Determine the effective interest of an investment as well as equivalent interest rates or

discount rates. Calculate gross and net return of savings products.
- Compute the equivalent dated value of a capital. Derive an equation of equivalence and solve it, including the specific applications studied such as the average due date.
- Compute the discounted value, the accumulated value or the interest rate or the number of payments of different types of annuities depending on the given data. When the computed number of payments is not an integer, compute the remaining amount.
- Develop different types of amortisation schemes of a debt. Compute the entries in the scheme at any payment time as well as the real cost of the loan. Adapt the amortisation scheme in the case of an early additional payment while keeping either the periodic payment or the pricipal repaid or the period unchanged.
- Determine the purchase price of a bond as well as the book value, the market price and the accrued interest based on either a gross return or a net return and computed at an interest date or between interest dates. For bonds redeemed in instalments, compute the entries in the bond table theoretically and in practice and compute the effective investment rate that an investor wants to realise.
- Compute the net single premium or the net annual premium of a life-insurance or a life-annuity by means of mortality tables. Compute the mathematical reserve for different types of insurance contracts usinge either the prospective method or the recursive formula by Fackler.

2 Develop well-reasoned the models starting from the hypotheses and give a correct financial interpretation with the help of a time axis.

3 Use of a pocket calculator or a spread sheet to carry out the computations.

4 Models should be developed for concrete cases but also be extended or made more general to cover other cases and vice versa.

5 • Analyse economic problems of financial mathematical nature on the basis of a profound knowledge and formulate scientific based solutions.
- Link a new problem to a studied problem and apply the techniques which were there developed.

6 Formulate a correct, complete and well-reasoned answer.

7 Remain critical during the process of solving a problem by incorporating checks.

8 Be aware of the impact of the height of the interest rate, of the advance tax payment, of the settlement dates, of the use of different life tables for male and female etc. on the return and total cost of financial and insurance products.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

Access to this course unit via an exam contract is unrestricted

Teaching methods

Seminar, Lecture

Extra information on the teaching methods

Theory: lectures.
Exercises: classes.

Study material

Type: Syllabus

Name: Financial Mathematics (partim A)
Indicative price: € 7
Optional: no
Language : Dutch
Available on Ufora : No
Online Available : No
Available through Student Association : No
Additional information: The lecture notes also contain problems and solutions to those problems. It will be announced on Ufora where and when to buy the lecture notes.

Type: Syllabus

Name: Financial Mathematics (partim B)
Indicative price: Free or paid by faculty
Optional: no
Language : Dutch
Available on Ufora : Yes
Online Available : Yes

Additional information: The lecture notes also contain problems and solutions to those problems.

Type: Slides

Name: Financial Mathematics (partim A and B)
Indicative price: Free or paid by faculty
Optional: yes
Language : Dutch
Available on Ufora : Yes
Online Available : Yes

References

- AYRES, F. - Mathematics of Finance. Schaum, New York, 1963.
- BONNEAU, P. - Les Mathématiques Financières et leurs Applications. Dunod, Paris, 1976.
- GERBER, H.U. - Life Insurance Mathematics, 3rd edition, Springer, Berlijn, 1997.
- GINGLINGER, E. & HASQUENOPH, J.M. - Mathématiques Financières. Economica, Paris, 1995.
- GIRARD, M. - Pratique des Mathématiques Financières. Economica, Paris, 1992.
- HUMMEL, P.M. & SEEBECK, C. - Mathematics of Finance. Mc Graw Hill, Tokyo, 1971.
- WOLTHUIS, H. & BRUNING R. - Levensverzekeringswiskunde, IAE, 1996.
- ZIMA, P. & BROWN, R.L. - Contemporary Mathematics of Finance. Schaum, New York, 1984.

Course content-related study coaching

Coaching for theory is done by the teacher and for exercises by the responsible assistant.
In the theory courses special attention is paid to practical examples and the exercise part in the lecture notes contains elaborated examples as well as solutions.
Additional support via Ufora (forums, email); personal support: by electronical appointment or during exercise sessions

Assessment moments

end-of-term assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment

Examination methods in case of periodic assessment during the second examination period

Written assessment

Examination methods in case of permanent assessment

Possibilities of retake in case of permanent assessment

not applicable

Extra information on the examination methods

Theory: written examination with the help of a formularium, this part of the exam tests whether students understand how the models are built and formulae are derived, and also whether they can give the correct financial interpretation of these models
Exercises: written examination with the help of a pocket calculator and a formularium, this part of the exam tests whether students can apply the models to practical problems.

Calculation of the examination mark

The final score is the weighted average of the scores for theory and exercises with equal weights of 1/2. One fails for the whole course when a score of less than 3/10 is obtained for theory or for exercises. In that case, when the final score sums up to a score larger than or equal to 10 to 20, it will be reduced to 9/20.