Introduction to Mathematical Finance - course description

General information

Course name	Introduction to Mathematical Finance
Course ID	11.5-WK-MATP-WMF-W-S14_pNadGenVM01B
Faculty	Faculty of Mathematics, Computer Science and Econometrics
Field of study	Mathematics
Education profile	academic
Level of studies	First-cycle studies leading to Bachelor's degree
Beginning semester	winter term 2020/2021

Course information

Semester	3
ECTS credits to win	6
Course type	optional
Teaching language	polish
Author of syllabus	• dr hab. Longin Rybiński, prof. UZ

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	30	2	-	-	Credit with grade
Laboratory	30	2	-	-	Credit with grade

Aim of the course

The student should accomplish basic tools for money time-value analysis, investment analysis, asset pricing and risk analysis, comparing and building investment strategies with derivatives.

Prerequisites

Calculus 1, 2, Linear Algebra 1, Probability Theory.

Scope

Lecture:

1. Simple, compound and continuous interest. Nominal and effective rates.
2. Mathematical models for varying rates.
3. Standard and nonstandard annuities and perpetuities.
4. Cash flows – present value, future value, internal rate of return, modified internal rate of return; investment cash flows.
5. Payment of a debt – schedule for a short term and long term debts; actual percentage rate.
6. Term structure of interest rates and yield curves. Bonds – zero-coupon bonds and coupon bonds; duration and convexity; immunization and matching assets and liabilities.
7. Pricing derivative securities – Black Scholes formula and Cox-Ross_Rubinstein formula.
8. Basics of portfolio theory; Capital Asset Pricing Model and Arbitrage Pricing Theory.
9. Von Neumann–Morgenstern expected utility.

Laboratory:

1. Present value and future value of payment in case of simple, discrete and continuously compound interest. Equivalence of nomianal and effective rate, equivalence of interest and discount rate.
2. Calculating present and future value of cash flow for constant and varying rates; annuities and perpetuities.
3. Internal rate of return (numerical aspects and spreadsheet calculation) and modified internal rate of return.
4. Tools for investment analysis: cash flow net present value, internal rate of return, profitability index, playback period. Solving practical problems.
5. Debt repayment plans. Calculation of payments and IRR based comparison of various debt repayment schedules.
6. Derivative securities (futur es, european and american and options) and basic option strategies – pricing in spreadsheet.

Teaching methods

Lectures – with conversation and online usage of financial and insurance data.
Laboratory – the use of spreadsheet functions, individual problem solving, individual project report.

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form

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Student knows how interpret functional relationships, tables, formulas and aply mathematical models to practical problems; project and compare investment strategies, using the basic notions of financial mathematics and spreadsheets; explore relevant literature and databases.		• a project • a test • an observation and evaluation of activities during the classes	• Lecture • Laboratory

Assignment conditions

Assessment of written test, ongoing review of laboratory work, project assessment. The final grade is a weighted mean of lecture grade (60%) and laboratory grade (40%).

Recommended reading

1. M. Dobija, E. Smaga, Podstawy matematyki finansowej i ubezpieczeniowej, PWN, Warszawa, 1995.
2. E. Nowak (red.), Matematyka i statystyka finansowa, Fundacja Rozwoju Rach., Finanse, Warszawa, 1994.
3. M. Podgórska, J. Klimkowska, Matematyka finansowa, PWN, Warszawa, 2005.
4. Piasecki K., Modele matematyki finansowej, PWN, Warszawa, 2007.

Further reading

1. A. Weron, R. Weron, Inżynieria finansowa, WNT, Warszawa, 1998.
2. Capiński M., Zastawniak T., Mathematics for Finance, Springer, 2003.
3. P. Brandimarte, Numerical Methods in Finanace, John Wiley & Sons, New York, 2002.

Notes

Modified by dr Alina Szelecka (last modification: 18-09-2020 13:45)