

1 Lectures

Class sessions:

- Lecturer: Fernando Dias (fernando.dias@aalto.fi);
- Session info: Mon, 10:15h - 12:00h (starting Sept 4th) - U3 - U141;

Exercise sessions:

- Teaching Assistant: Leevi Olander (leevi.olander@aalto.fi) and Jaakko Wallenius (jaakko.wallenius@aalto.fi);
- Session info: Tue, 14:15h - 15:00h - D-sali - Y122;

2 Course description

Investment science refers to applying mathematical modelling to inform investment decisions. This course focuses on financial investments, including investments into bonds and stocks and derivative securities such as forwards, futures, swaps, and options.

The analysis of investment decisions requires a sound understanding of cash flow dynamics, stochastic processes, pricing, and valuation of investments. This course gives a well-rounded introduction to all these topics, thus ensuring that the students master these fundamental concepts of investment science and are able to apply them successfully in practice.

3 Learning outcomes

The student has a good understanding of the key concepts and methods of investment science, including topics such as interests rates; cash flow analysis; Markowitz' portfolio theory; capital asset pricing model; arbitrage pricing theory; forward, futures and option contracts; pricing of options; hedging; interest rate derivatives; interest rate dynamics.

The student is able to formulate and solve problems involving financial instruments. The student has a strong foundation for pursuing advanced studies in financial engineering and quantitative finance.

Upon completing this course, the student should be able to

- **understand** how several important concepts arising from diverse fields involving investment decisions;
- **familiarise** themselves with concepts and process common to investments;
- know the main techniques for **modelling** and **handling** investment problems and how to apply them successfully in practice;

4 Teaching methods

The course will be taught by a composition of the following methods:

- lectures;
- guest lecture (s);
- assignments and exercise;
- final exam.

The lectures will be in person (although their recording will be available on MyCourses). For the exercise sessions and to address general questions about the course content or administration, we will use Zulip. Zulip is the standard chat platform in the Department of Mathematics and Systems Analysis and offers the possibility for calls and using Latex on messages.

As preparation for the lectures (Mondays at 10.15h-12.00h), the students will be encouraged to study and familiarise themselves with the lecture notes (about 10 pages per lecture) beforehand and, in case of any questions, formulate them before or during the lectures.

The exercise sessions will happen as demonstration sessions, in which the students are requested to attempt to solve the exercises independently, followed by the aid of a teaching assistant.

The time slot of the exercise sessions will work as office hours for the students to clarify questions related to content, homework and assignments.

Remark: Reception hour: Lecturer: Wednesdays at 15:00 - 16:00 in room Y214 (Otakaari 1). Please confirm the appointment by contacting via email first.

5 Assessment

The final grade of the course is composed of three components:

FE: Final exam;

AE: Assignment & exercises:

Each component will be graded individually on a scale of 0-100. The final grade *FG* will be calculated as

$$FG = 0.65 \times FE + 0.35 \times AE$$

The conversion scale for the 1-5 scale is as follows.

1-5	0-100
Fail	0-50
1	51-60
2	61-70
3	71-80
4	81-90
5	91-100

Table 1: Conversion from 0-100 to 1-5 scale

Remark: Five points will be given for attendance at the guest lecture(s), which details will be announced further into the course.

5.1 Assignment & Exercise

A total of 8 assignment *A* and 11 exercises *EX* will be handed out throughout the course. The combined marks for these tasks are 35 points, adding to 100 points. The following composition between assignment and exercises is described below:

$$Total = 0.75 \times A + 0.25 \times EX$$

Each week has an exercise associated to it that rewards course points starting with Week 2. The schedule for the assignments can be found in the "MyCourses" page in the section regarding assignment and exercises.

5.2 Final Exam

The students will be requested to take a final exam which will be conducted individually at the end of the course. This exam corresponds to 65% of the final grades for the course. During the exam, only a standard calculator is permitted.

6 Course material

Main study material: lecture notes, lecture slides, exercise tutorials, homework assignments, course book.

The lecture material is mostly based on the main course book *David G. Luenberger (1998 1st edition, 2013 2nd edition) Investment Science Oxford University Press, New York.*

7 Electronics policy

As a general rule, do not be rude! You are free to use electronic devices during class for note-taking purposes. I strongly encourage bringing the lecture notes for each class and having a look at them beforehand.

8 Course schedule

A tentative schedule for the course is given. The content of each class may be adapted according to the pace of the classes.

Week	Lecture	Content
35	I	Cash Flow Analysis
36	II	Fixed income securities
37	III	Term structure of interest rates
38	IV	Term of interest rates
39	V	Applied interest rate analysis
40	VI	Modern portfolio theory
41	–	<i>Break between Periods I and II</i>
42	VII	Arbitrage Pricing Theory
43	VIII	Derivative instruments
44	IX	Basic options theory
45	X	Options pricing (discrete)
46	XI	Options pricing (continuous)
47	XII	Interest rate derivatives

Table 2: Schedule of classes

9 Workload estimate

The table below shows an estimate of the total workload of the course. Recall that each ECT credit is equivalent to 28h of work; thus, 5 ECTs are equivalent to 140h.

Activity	Hours	# Events	Total hours
Self study (notes)	3	12	36
Contact session	2	12	24
Exercises	2	11	22
Assignment	6	8	48
	Total workload:		130

A total of 130 hours for 5 credits, averaging around 26 hours/credit, which is around the standards established by the university.