MATHEMATICAL FINANCE

Course code	*GRAE017*
Course title	*Mathematical Finance*
Type of course	*Compulsory*
Stage of study	*MSc*
Year of study	*1st*
Semester	*Autumn*
ECTS	*6*
	18 hours of theory, 18 hours of practice, 124 hours of self-study, 2 hours of consultations.
Coordinating lecturer	*Tom Hashimoto (Room 205)*
	tomhas@ism.lt
Studies form	*Full-time*
Prerequisites	*N/A*
Language of instruction	*English*

COURSE DESCRIPTION

This introductory course surveys various mathematical concepts utilised in financial economics. Together with Financial Econometrics, it constitutes the foundation of the 'research' pillar in MSc Financial Economics at ISM. As such, some of the topics will be 'repeated', but more in depth, in other courses. As clients' profiles and objectives have become increasingly global and complex over the past few decades, financial institutions have come up with more sophisticated and more structured products, alternatives, and approaches, some of which are reviewed in this course from a pricing and mathematical perspective. Given the current political environments (e.g. transpacific trade war, COVID), we pay significant attention to the assumptions behind formulae and models, while we practice not only calculations but also explanations to prepare ourselves for the contemporary regulatory environment, most notably characterised by the MiFID II.

COURSE OBJECTIVES

Course learning outcomes (CLO)	Study methods	Assessment methods
CLO1. Illustrate and utilise the axioms of rationality in pricing.	Lectures, self-study	Midterm, Final exam
CLO2. Define and explain interest rates as they are applied to different types of debt instruments.	Lectures, seminars, self-study	Midterm, Final exam
CLO3. Define and explain the structuring considerations for various derivative products.	Lectures, seminars, self-study	Midterm, Final exam
CLO4. Identify issues and projects surrounding the rapidly changing world such as hybrid securities, financial engineering, and blockchain.	Seminars, self-study	Final exam

COURSE CONTENT

Lecture	TOPIC	CLASS HOURS		READINGS
		Lecture	Seminar	
1	**Introductory discussion**. Overview of MSc Financial Economics. Overview of financial instruments and markets.	3	1	
2	Mathematics of compounding. Simple, compound, and varying interest rates,	2	2	Chs. 1.1 & 1.2
3	Mathematics of compounding (cont.). Annuities, bonds, yield rates.	2	2	Chs. 1.3 – 1.5
4	Basic price models. Binomial model, log-normal model, Law of One Price.	3	1	Chs. 2.2 & 2.3
5	**Review.** **Midterm**.	--	4	
6	Discrete time market models. Cox-Ross-Rubinstein model, option pricing.	3	1	Chs. 7.1 & 15.2
7	Basics of Ito calculus and stochastic analysis. Brownian motion, Diffusion Markov processes.	3	1	Ch. 6.3
8	Introduction to Econometric Analysis (GRETL) **Laptop required!**	1	3	Please download GRETL beforehand
9	Econometric analysis and modelling **Laptop required!** Review	1	3	
--	**Final Examination** **Retake Examination**	--	--	
	Total:	**18**	**18**	

ASSESSMENT METHODS

Assignment	Total hours	Final grade, %
Midterm Exam	50	40%
Final Exam	74	60%
Total:	124	100%

1. Both the midterm and final exams are open book. Students can refer to their notes and textbooks during the exam.

2. The midterm exam will cover the topics from the first four lectures. The final exam will cover all topics discussed during the course with more weight on the topics covered after the midterm. The retake exam will cover all topics without such preferences.

3. The retake exam for the students who did not meet the passing score is normally scheduled 1-2 weeks after the announcement of the final grades.

Attendance policy:

Regular attendance is strongly encouraged as both exams are open book. If for some reasons you need to miss a class, please notify the lecturer *beforehand*.

Please note, due to the travel/health regulations in place, we will take attendance (both physical and online) at the beginning of each class in order to monitor the situation.

Plagiarism policy:

Plagiarism is prohibited by the University and will be referred to the Programme Director and the Ethics Committee. If you have any concerns or questions, please contact the lecturer *before* the submission. Please remember that citing somebody is *not* a problem (actually, even encouraged in case of academic sources), but citing somebody *without* proper citation is. The same rule applies when you paraphrase or translate the materials.

Course textbook:

Please utilise them as encyclopaedia rather than core reading.

- Campolieti, G. & Makarov R.N. (2014) *Financial Mathematics*. London: CRC Press.

For those who are looking for additional challenge:

- Dokuhcaev, N. (2007) *Mathematical Finance*. London: Routledge.

NB: Students are expected to be acquainted with the undergraduate level of mathematics and statistics. Therefore, if a student feels shortage of knowledge and wants to improve his/her understanding in quantitative methods, the lecturer is available for further consultation by appointment.

MSc Financial Economics programme at ISM has zero tolerance policy towards cheating, plagiarism, and other academic misconducts. Such incidents will be referred to the Committee on Ethics.