M123	**Mathematical Finance**	L	P	S	ECTS
		2	0	2	6

Course objectives. Differentiating between basic financial instruments and derivatives and understanding the concepts of their valuation within different stochastic models of financial market.

Prerequisites. Financial and Actuarial Mathematics, Probability, Stochastic Processes I, Stochastic Processes II. Statistics.

Course content.

1. Financial market. Basic assumptions in mathematical models of financial market. Basic and derivative financial instruments. Portfolio. Arbitrage. The concept of non-arbitrary valuation of derivatives.
2. Models of discrete-time financial market. Price modelling for risky financial instruments. Contingent claim. Non-arbitrage evaluation of contingent claims. Reachability of a contingent claim. Completeness of the financial market. Working with financial data in a software environment.
3. A continuous-time financial market model. Price modelling for risky financial instruments. Contingent claim. Non-arbitrage evaluation of contingent claims under assumption that stock prices follow the geometric Brown motion - Black-Scholes-Merton model. Numerical evaluation of contingent claims within the financial market with more general assumptions. Application of these models to financial data in the software environment.
4. Risk measures. Assessment and modelling of risk measures. Application of risk measures to the financial data in the software environment.

No.	LEARNING OUTCOMES
1.	Differentiating the types of financial instruments, their meaning and interpretation in accordance to the specific financial market model.
2.	Understanding the concept of risk and the benefits and limitations of risk measures.
3.	Distinguishing stochastic models of financial market in a discrete and continuous time.
4.	Analysing stochastic models of financial markets and understanding their advantages and limitations in real situations.
5.	Identifying adequate stochastic models for solving specific financial market problems.
6.	Applying adequate valuation models of risky and derivative financial instruments to real data in a software environment.
7.	Applying adequate risk measures to real data in a software environment.
8.	Combining concepts and methods from course content for solving more complex problems.

RELATING THE LEARNING OUTCOMES, ORGANIZATION OF THE EDUCATIONAL PROCESS AND ASSESSMENT OF THE LEARNING OUTCOMES

TEACHING ACTIVITY	ECTS	LEARNING OUTCOME **	STUDENT ACTIVITY*	EVALUATION METHOD	POINTS	
					min	max
Attending lectures and exercises	1.5	1-8	Lecture attendance, discussion, team work, independent work on given tasks	Attendance lists, tracking activities	0	5

			and short examination			
Written exam (Mid-terms)	2	1-8	Preparing for written exam	Evaluation	20	40
Seminar	1	4-8	Preparing a seminar paper and presentation of the results	Evaluation	10	15
Final exam	1.5	1-8	Revision	Oral exam	20	40
TOTAL	6				50	100

Teaching methods and student assessment. Lectures and exercises are obligatory. The final exam is oral, taken after the completed lectures and exercises and achieved minimum number of credits at the midterm exams. Students can influence the grade by writing homework during the semester.

Can the course be taught in English: Yes

Basic literature:

1. A. O. Petters, X. Dong, An Introduction to Mathematical Finance with Applications, Springer, 2016.
2. N. Shiryaev, Essentials of Stochastic Finance, World Scientific, 2003.

Recommended literature:

1. J. Baz, G. Chacko, Financial Derivatives – Pricing, Applications and Mathematics, Cambridge University Press, 2004.
2. J. Cvitanić, F. Zapatero, Economics and Mathematics of Financial Markets, The MIT Press, 2004.
3. M. Capinski, T. Zastawniak, Mathematics for Finance: An Introduction to Financial Engineering, Springer, 2005.
4. P. Kloeden, E. Platen, Numerical Solution of Stochastic Differential Equations, Springer, 1999.
5. T. Mikosch, Elementary Stochastic Calculus With Finance in View, World Scientific, 2000.
6. Z. Vondraček, Financial modelling (web material in croatian), Faculty of Natural Sciences - Department of Mathematics, University of Zagreb, 2018.