



Course description

Course title	Course code
Financial technology models (Finansinių technologijų modeliai)	

Lecturers	Department where the course is delivered
Coordinator: partnership prof. dr. Rokas Gyls.	Department of Mathematical Analysis Faculty of Mathematics and Informatics Naugarduko St. 24, LT-03225 Vilnius, Lithuania

Cycle	Type of course
Second	Mandatory

Mode of delivery	Semester or period when the course is delivered	Language of instruction
Face-to-face	1 st semester (Fall)	Lithuanian, English

Prerequisites and corequisites	
Prerequisites: algebra, probability theory, mathematical statistics, financial mathematics, other mathematical disciplines, programming skills (R or Python).	Corequisites (if any):

Number of ECTS credits	Student's workload	Contact hours	Individual work hours
5	125	40	85

Course objectives: programme competences to be developed		
<p>The objective of the course is to develop students' ability to apply the mathematical knowledge in solving the real-life problems encountered in the modern financial services industry, in particular, in the financial technology (fintech) sector. The course focuses on the key mathematical methods applied by businesses operating in the fintech sector and their practical application. The topics include blockchain, cryptography, data analytics, machine learning and modern statistical methods. The theoretical studies of the mathematical models are combined with case studies of their practical application in the financial services area, including presentations of the guest speakers from the Lithuanian financial services industry.</p>		
Learning objectives. At the end of the course a student:	Learning methods	Assessment methods
<ul style="list-style-type: none"> – Understand how innovation and digitalization is changing the business environment, business models and processes in the financial services. 	Lecture, case analysis, home assignments	Written test
<ul style="list-style-type: none"> – Develop the ability to analyze properties of the mathematical models related to blockchain, data analytics and risk management. 		
<ul style="list-style-type: none"> – Develop the ability to apply mathematical models in solving real life business problems. 	Explanation, demonstration, group learning	Evaluation of the results of home assignments
<ul style="list-style-type: none"> – Be able to apply the theoretical knowledge in building models with real life datasets. 		
<ul style="list-style-type: none"> – Be able to use software tools (R, Python) in the financial services environment. 		
<ul style="list-style-type: none"> – Be able to present the results of the analysis effectively. 		

Course content: breakdown of the course	Contact hours			Individual work hours and assignments	
	Lectures	Practical training	Total contact hours	Individual work hours	Assignments
1. Introduction to the key concepts, business models and the key technologies applied by fintech companies.	3	1	4	5	Read [1]. Solve assigned problems.
2. Overview of the regulatory environment affecting the financial services businesses.	2	1	3	-	-
3. Application of cryptographic models in blockchain and fintech.	2	2	4	4	Recap on the key abstract algebra concepts and theorems. Solve assigned problems.
4. Blockchain technology and its applications in the financial services.	2	2	4	6	Read Bitcoin whitepaper: https://bitcoin.org/bitcoin.pdf
5. Classification and regression models, support vector machines and their applications.	3	2	5	6	Read assigned text. Solve assigned problems.
6. Tree based models and ensemble methods and their applications.	2	2	4	4	Read assigned text. Solve assigned problems.
7. Dimensionality reduction and unsupervised learning.	2	2	4	4	Read assigned text. Solve assigned problems.
8. Artificial neural network (ANN) models and their applications.	2	2	4	6	Read assigned text. Solve assigned problems.
9. Introduction to artificial intelligence (Generative Adversarial Networks, Large Language Models).	2	2	4	6	Read [4]. Solve assigned problems.
Interim test		2	2	16	
Final exam	-	2	2	30	
Total:	20	20	40	85	

Assessment strategy	Weight	Time of assessment	Criteria
Interim test	20%	During the semester	The maximum grade is given for correctly solved tasks and correctly formulated conclusions. If a task is not fully solved, the grade is reduced proportionally.
Evaluation of the home projects and assignments	30%	During the semester	During the semester, students will be given assignments (empirical data research, problems, reading assignments). The maximum grade is given for correctly completed tasks and correctly formulated conclusions. If the task is not fully solved, the grade is reduced proportionally.

Final exam	50%	End of the semester	<p>Typically, the exam consists of 10 multiple choice questions (total weight of 33.33%), several mathematical problem solving tasks (total weight of 33.33%) and one case study type exercise (total weight of 33.33%).</p> <p>The maximum grade is given for correctly solved tasks and correctly formulated conclusions. If a task is not fully solved, the grade is reduced proportionally.</p>
The overall assessment is the sum of weighted grades.			

Author	Publication year	Title	Volume and/or publication number	Publication place and publisher
Required reading				
1. L. Breiman	2001	Statistical Modeling: The Two Cultures, <i>Statistical Science</i>	16-3, pp199-231	
2. C.M. Bishop	2006	<i>Pattern recognition and machine learning</i>	-	Springer Book available on-line: https://www.microsoft.com/en-us/research/publication/pattern-recognition-machine-learning/
3. G. James et al	2023	<i>An Introduction to Statistical Learning with Applications in Python</i>		Springer Book available on-line: https://www.statlearning.com/
4. I. Goodfellow et al.	2020	Generative Adversarial Networks. <i>Advances in neural information processing systems</i>	pp. 2672–2680	
Recommended reading				
3. J.A. Buchmann	2000	<i>Introduction to Cryptography</i>	-	Springer
4. W. McKinney	2017	<i>Python for Data Analysis: Data Wrangling with Pandas, NumPy, and iPython</i>	-	O'Reilly
5. A. Geron	2017	<i>Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems</i>	-	O'Reilly