Course description

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

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

Cycle	Type of course
First	Mandatory

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

Prerequisites and corequisites	
Prerequisites: algebra, probability theory, mathematical statistics, financial mathematics, financial risk management, 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		
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.		
Learning objectives. At the end of the course a student:	**Learning methods**	**Assessment methods**
– Develop ability to analyze various business models and business environment of fintech companies.	Problematic lecture, case analysis	Written test
– Develop the ability to analyze properties of the key mathematical models used by fintech companies.		
– Develop the ability to analyze application of the mathematical models in the financial services area.		
– Be able to apply the theoretical knowledge by building models with real life datasets.	Explanation, demonstration, group learning	Evaluation of the results of group assignment
– Be able to use software tools (R, Python) in the financial services environment.		

– 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.	**2**	**-**	**2**	**5**	Decide on the groups for the group assignment. Read [1]
2. Overview of the regulatory environment affecting the financial services businesses.	**2**	**-**	**2**	**-**	-
3. Blockchain technology and its applications in the financial services.	**2**	**2**	**4**	**2**	Read Bitcoin whitepaper: https://bitcoin.org/bitcoin.pdf
4. Application of cryptographic models in blockchain and fintech.	**2**	**2**	**4**	**6**	Study the key abstract algebra concepts and theorems (separate list will be provided). Solve assigned problems.
Interim test	**-**	**2**	**2**	**12**	
5. Classification and regression models, support vector machines and their applications.	**3**	**2**	**5**	**6**	Read §3, §4 and §9 of book [2]. Solve assigned problems.
6. Tree based models and ensemble methods and their applications.	**2**	**2**	**4**	**4**	Read §8 of book [2]. Solve assigned problems.
7. Artificial neural network (ANN) models and their applications..	**3**	**2**	**5**	**4**	Read §10 of book [2]. Solve assigned problems.
8. Dimensionality reduction and unsupervised learning.	**2**	**1**	**3**	**4**	Read §12 of book [2]. Solve assigned problems.
9. Risk management models in the financial services environment.	**2**	**1**	**3**	**-**	-
Group assignment		**4**	**4**	**22**	Prepare group assignment and present to the group
Final test	**-**	**2**	**2**	**20**	
Total:	**20**	**20**	**40**	**85**	

Assessment strategy	Weight	Time of assessment	Criteria
Evaluation of the group assignment The aim of the assignment is to create a model, perform calculations and present the results using	**30%**	During the semester	Requirements for the model: 1) Selection of appropriate mathematical form; 2) Data cleaning and transformation; 3) Implementation of the model using a selected software tool; 4) Model testing and analysis of results;

the suggested dataset. The assignment shall be performed by students working in groups.			5) Interpretation of results; 6) Preparation of presentation slides; 7) Oral presentation; Evaluation is the average of the scores given for each of the above steps of model creation.
Interim test	**30%**	Mid of the semester	In this exam, students are tested on the material from the first half of the semester. Typically, the exam consists of 10 multiple choice questions (total weight of 30%), three mathematical problem solving tasks (total weight of 30%) and one case study type exercise (total weight of 40%).
Written test	**40%**	End of the semester	In this exam, students are tested on the material from the first half of the semester. Typically, the exam consists of 10 multiple choice questions (total weight of 30%), three mathematical problem solving tasks (total weight of 30%) and one case study type exercise (total weight of 40%).
The overall assessment is the sum of weighted grades rounded up to the nearest integer.			

Author	**Publication year**	**Title**	**Volume and/or publication number**	**Publication place and publisher**
Required reading				
1. L. Breiman	2001	Statistical Modeling: The Two Cultures, Statistical Science	16-3, pp199-231	
2. G. James, D. Witten, T. Hastie and R. Tibshirani	2021	An Introduction to Statistical Learning: with Applications in R, 2nd ed.	-	Springer Book available on the website: https://www.statlearning.com/
Recommended reading				
3. A. M. Antonopoulos	2004	Mastering Bitcoin - Programming the Open Blockchain	-	O'Reilly Book available on the website: https://github.com/bitcoinbook/bitcoinbook
4. C.M. Bishop	2006	Pattern recognition and machine learning	-	Springer Book available on the website: https://www.microsoft.com/en-us/research/publication/pattern-recognition-machine-learning/
5. J.A. Buchmann	2000	Introduction to Cryptography	-	Springer
6. A. Geron	2017	Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems	-	O'Reilly
7. W. McKinney	2017	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and iPython	-	O'Reilly