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
Second	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, 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**
– 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
– Develop the ability to analyze properties of the mathematical models related to blockchain, data analytics and risk management.		
– Develop the ability to apply mathematical models in solving real life business problems.		
– Be able to apply the theoretical knowledge in 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**	Recap on the key abstract algebra concepts and theorems. Solve assigned problems.
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. Artificial neural network (ANN) models and their applications.	**3**	**2**	**5**	**4**	Read assigned text. Solve assigned problems.
8. Dimensionality reduction and unsupervised learning.	**2**	**1**	**3**	**4**	Read assigned text. Solve assigned problems.
9. Risk management models in the financial services environment.	**2**	**1**	**3**	**-**	-
Group assignment		**6**	**6**	**30**	Prepare group assignment and present to the group
Final test	**-**	**2**	**2**	**24**	
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 the suggested dataset. The assignment shall be	**35%**	During the semester	Requirements for the model: 1) Data cleaning, transformation, understanding. 2) Selection of trial models. 3) Writing code using selected software tool. 4) Model testing, finetuning and selection of the final model. 5) Analysis and interpretation of results. 6) Preparation of presentation of slides.

performed by students working in groups.			7) Oral presentation. Evaluation is the average of the scores given for each of the above steps of model creation.
Written test	**65%**	End of the semester	Typically, the exam consists of 10 multiple choice questions (total weight of 33.33%), severalmathematical problem solving tasks (total weight of 33.33%) and one case study type exercise (total weight of 33.33%).
The overall assessment is the sum of weighted grades rounded up to the nearest integer.			

Author	Publication year	Title	Volume and/ publication number	Publication place and publisher
Required reading				
1. L. Breiman	2001	Statistical Modeling: The Two Cultures, Statistical Science	16-3, pp199-231	
2. 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/
Recommended reading				
3. J.A. Buchmann	2000	Introduction to Cryptography	-	Springer
4. W. McKinney	2017	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and iPython	-	O'Reilly
5. A. Geron	2017	Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems	-	O'Reilly