



COURSE UNIT DESCRIPTION

Course unit title	Course unit code
Blockchain Technologies	

Lecturer(s)	Department where the course unit is delivered
Koordinuojantis: Saulius Grigaitis Kitas (-i):	Department of Software Engineering Institute of Computer Science Vilnius University

Cycle	Type of the course unit
1 st (BA)	Optional

Mode of delivery	Semester or period when the course unit is delivered	Language of instruction
Face-to-face	5 th , 7 th semester	Lithuanian, English

Prerequisites
Prerequisites:

Number of credits allocated	Student's workload	Contact hours	Individual work
5	133	66	67

Purpose of the course unit: programme competences to be developed		
<p>Purpose of the course unit: to provide students with basic knowledge of distributed ledger technologies by focusing on one of their types - blockchain technologies, their operation principles, algorithms used. Introducing to the development of such distributed systems using Rust.</p>		
Learning outcomes of the course unit: students will be able to	Teaching and learning methods	Assessment methods
<ul style="list-style-type: none"> • Understand the principles of distributed ledger technologies. • Understand how the principles of distributed systems are used in distributed ledger technologies. • Understand the unique principles of blockchain technologies that are not specific to the other types of distributed ledger technologies. • Use blockchain frameworks and libraries. • Use blockchain technologies to develop applications. • Use Rust programming language and instrumental tools to create blockchain systems. 	Lectures, problem-oriented teaching, case studies, literary reading, individual work, tutorials, laboratory work.	Laboratory works and results presentation, written exam (open, semi-open and close-ended questions and tasks).

Course content: breakdown of the topics	Contact hours							Assessment methods	
	Lectures	Tutorials	Seminars	Practice	Laboratory work	Practical training	Contact hours	Individual work	Assignments
Introduction.	2						2	2	Individual reading. Laboratory works. Self-control tasks.
Principles of distributed ledger technologies.	2				2		4	4	
Principles of blockchain technologies. Cryptocurrencies. Smart Contracts.	4				4		8	8	
Distributed systems theory. FLP impossibility. Synchronous, asynchronous and partially synchronous network models. Fault types. Fault detectors. Leader election. Time in distributed systems. Consensus properties.	4				6		10	8	
Byzantine generals problem. PoW, PoS, pBFT, dBFT and other BFT consensus algorithms.	4				4		8	7	
Cryptography in blockchain technologies.	2				2		4	5	
Architectures of blockchain technologies.	2				2		4	5	
Frameworks and libraries for blockchain development.	2				2		4	5	
Introduction to Rust programming and ecosystem.	2				2		4	5	
Rust functional programming.	2				2		4	4	
Rust memory model.	2				2		4	4	
Rust parallel programming.	2				2		4	4	
Automated testing with Rust.	2				2		4	4	
Tutorials during the semester		2					2		
Final exam (written)									
Total	32	2			32		66	67	

Assessment strategy	Weight %	Deadline	Vertinimo kriterijai
Laboratory works	60	During the semester	During the semester, a group of students is required to complete a single project. The assessment of the project is divided into no more than 5 stages. The stages are of different complexity with the corresponding maximum scores for each stage. The maximum score for all stages is 6 points, which corresponds to 60% of the final score. It is required to get at least 2 points to be allowed to take the exam.
Exam (written)	40	Exam session	During the exam, it is possible to get at most 4 points, which are equivalent to 40% of the final score. During the examination, the student must answer various questions of diverse complexity (0-4 points). The student must provide answers to multiple different open, semi-open and closed type questions of different complexity (0-4 points).

Author	Publ hing year	Title	Number or volume	Publisher or URL
Required reading				
Satoshi Nakamoto	2008	Bitcoin: A Peer-to-Peer Electronic Cash System		https://bitcoin.org/bitcoin.pdf
Vitalik Buterin, Virgil Griffith	2019	Casper the Friendly Finality Gadget		https://arxiv.org/abs/1710.09437
Steve Klabnik and Carol Nichols	2018	The Rust Programming Language		California, USA. No Starch Press
Recommended reading				
Miguel Castro, Barbara Liskov	1999	Practical Byzantine Fault Tolerance		http://pmg.csail.mit.edu/papers/osdi99.pdf
Maarten van Steen, Andrew S. Tanenbaum	2017	Distributed Systems (3 rd Edition)		California, USA. CreateSpace Independent Publishing Platform.