

Biomatics and Applied Artificial Intelligence Institute			Semester 3. of the curriculum 2024-25-1			
Name of the subject:	Code of the subject:	Credits:	Hours per semester:			
				lec	sem	lab
Introduction to blockchain programming	NBXP0EMLF	4	part-time	5	0	10
Responsible person for the subject: Prof. Dr. LAZÁNYI Kornélia			Classification: professor			
Subject lecturer(s): Dániel Szegő						
Prerequisites:						
Way of the assessment:			mid-term grade			
Course description						
Goal:	The course aims to provide a technological and programming introduction to distributed ledger technology through the two most typical protocols through Bitcoin and Ethereum. The lectures of the course mostly concentrate on the theoretical and practical aspects of blockchain protocols, whilst in the laboratory and exercise part we will focus on Ethereum, solidity smart contract and Web3 programming.					
Course description:	Distributed ledger technology is expected to be one of the most significant transformative technologies of the decade, fundamentally influencing both present and future financial services and the creation of the value-based Internet. Although the legal regulation of the topic is still questionable in some places, the basic technological stack appears either in various cryptocurrencies, e.g. Bitcoin, or in more innovative consortium services launched by some banks.					

Lecture schedule	
Education week	Topic
1.	Introduction to blockchain, disruptive technologies and technology life-cycles. Bitcoin history.
2.	DLT platform working mechanism and platform comparison (transactions, signatures, smart contract, P2P network, consensus, transactional database).
3.	DLT platform working mechanism and platform comparison (Open Blockchain versus consortium DLT, Cryptocurrencies, Smart contract platforms, Ethereum, Hyperledger ...).
4.	Cryptography and PKI summary.
5.	Elements of the decentralized infrastructure: keys, key generation, wallets.
6.	Elements of the decentralized infrastructure: Merkle trees, authenticated data structures, blocks, blockchain as a data structure.
7.	Elements of the decentralized infrastructure: P2P network. Consensus theory.
8.	Elements of the decentralized infrastructure: Blockchain consensus., PoW, mining, difficulty hashrate, PoS.
9.	Ethereum platform summary and deep-dive: EVM, bytecode, Accounts, smart contract call semantics ...
10.	Introduction to tokenization
11.	Tokenization deep dive
12.	Architecting decentralized applications: DApp, Web3, layered architectures, Oracles, security, TDD.
13.	Selected topics from DeFi, blockchain security, consortium blockchain challenges or CBDC.

14.	Closing the course. Optional written evaluation. Optional and bonus content. Guest lecturers
Mid-term requirements	
Conditions for obtaining a mid-term grade/signature	Class activities and assignment.
Assessment schedule	
Education week	Topic
Method used to calculate the <i>mid-term grade</i> (to be filled out only for subjects with mid-term grades)	
<ol style="list-style-type: none"> Several small challenges, essays and challenges at each lecture. Each can be evaluated up to 10 points. Students can choose which to solve. Programming assignment: There is a compulsory solidity programming assignment in solidity that is evaluated up to 70 points. The programming assignment can be done individually or in 2-3 people groups as well. 	
Type of the replacement	
Type of the replacement of written test/mid-term grade/signature	In case someone could not manage to accomplish homeworks or assignments during the course there is the possibility for a written replacement test at the last week.
Type of the exam (to be filled out only for subjects with exams)	
Calculation of the exam mark (to be filled only for subjects with exams)	
Final grade calculation methods:	
123-140 points – 5 105-122 points – 4 88-104 points – 3 71-87 points – 2 0-70 points – 1	
References	
Obligatory:	Andreas M. Antonopoulos, Mastering Bitcoin, https://github.com/bitcoinbook/bitcoinbook Andreas M. Antonopoulos, Gavin Wood, https://github.com/ethereumbook/ethereumbook
Recommended:	
Other references:	Articles provided during class