syllabus

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computers and Information Technology**
1.5 Study cycle	**Undergraduate**
1.6 Study programme / Qualification	**Information Engineering**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)			**Blockchain: Smart Contracts Blockchain: Smart Contracts**				
2.2 Course coordinator			**Assoc. Prof. Eng. Florin Craciun**				
2.3 Seminar coordinator			**Assoc. Prof. Eng. Florin Craciun**				
2.4. Year of study	**4**	2.5 Semester	**8**	2.6. Type of evaluation	**C**	2.7 Type of discipline	**Optional DS**
2.8 Code of the discipline		MLE5157					

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	5	Of which: 3.2 course		2	3.3 seminar/laboratory	1 LP 2 P
3.4 Total hours in the curriculum	70	Of which: 3.5 course		28	3.6 seminar/laboratory	42
Time allotment:						hours
Learning using manual, course support, bibliography, course notes						15
Additional documentation (in libraries, on electronic platforms, field documentation)						5

Preparation for seminars/labs, homework, papers, portfolios and essays						25
Tutorship						5
Evaluations						5
Other activities:						
3.7 Total individual study hours		55				
3.8 Total hours per semester		125				
3.9 Number of ECTS credits		5				

4. Prerequisites (if necessary)

4.1. curriculum	· none
4.2. competencies	· programming languages

5. Conditions (if necessary)

5.1. for the course	· video projector
5.2. for the seminar /lab activities	· video projector

6. Specific competencies acquired

Professional competencies	· C3.1 Identifying classes of problems and solving methods that are specific to computing systems · C3.2 Using interdisciplinary knowledge, solution patterns and tools, making experiments and interpreting their results · C3.3 Applying solution patterns using specific engineering tools and mehods · C3.4 Comparatively and experimentaly evaluation of the alternative solutions for performance optimization · C3.5 Developing and implementing information system solutions for concrete problems · C4.1 Identifying and describing technologies, programming environments and various concepts that are specific to programming engineering · C4.2 Explaining the role, interaction and operation patterns of software system components · C4.3 Developing specifications and designing information systems using specific methods and tools · C4.5 Developing, implementing and integrating software solutions
Transversal competencies	· CT1 Honorable, responsible, ethical behavior, in the spirit of the law, to ensure the professional reputation · CT3 Demonstrating initiative and pro-active behavior for updating professional, economical and organizational culture knowledge

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	· Understanding of the main concepts and techniques of blockchain technology, with main focus on smart contracts
7.2 Specific objective of the discipline	· To understand the execution model of Ethereum platform · To understand bitcoin concepts · To understand the execution of smart contracts · To learn how to wite smart contracts · To become familiar with the tools which automatically analise, optimize and verify smart contract

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction into Blockchain foundations and applications	Exposure, description, explanation, debate and dialogue, discussion of case studies	
2. Basics of Ethereum	Exposure, description, explanation, debate and dialogue, discussion of case studies	
3. Introduction in Smart contracts	Exposure, description, explanation, debate and dialogue, discussion of case studies	
4. Smart contracts. Design patterns in Solidity	Exposure, description, explanation, debate and dialogue, discussion of case studies	
5. Advanced topics on Solidity	Exposure, description, explanation, debate and dialogue, discussion of case studies	
6. Decentralized Applications	Exposure, description, explanation, debate and dialogue, discussion of case	

	studies	
7. Bitcoins. Foundations	Exposure, description, explanation, debate and dialogue, discussion of case studies	
8. Bitcoins. Advanced topics	Exposure, description, explanation, debate and dialogue, discussion of case studies	
9. Consensus protocols. Foundations	Exposure, description, explanation, debate and dialogue, discussion of case studies	
10. Consensus protocols. Advanced topics	Exposure, description, explanation, debate and dialogue, discussion of case studies	
11. Security in Ethereum	Exposure, description, explanation, debate and dialogue, discussion of case studies	
12. Mining strategies, Mining attacks	Exposure, description, explanation, debate and dialogue, discussion of case studies	
13. Advanced topics on Blockchain verification	Exposure, description, explanation, debate and dialogue, discussion of case studies	
14. The future of Blockchain	Exposure, description, explanation, debate and dialogue, discussion of case	

	studies	
Bibliography 1. (Main textbook-free available)Narayanan, Bonneau, Felten, Miller and Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction 2. Bonneau, Miller, Clark, Narayanan, Kroll and Felten , Research Perspectives and Challenges for Bitcoin and Cryptocurrencies 3. Jeremy Clark , an extensive online bibliography of Bitcoin research papers 4. Bitcoin Developer Reference 5. Satoshi Nakamoto , Bitcoin: A Peer-to-Peer Electronic Cash System 6. Ethereum extensive wiki 7. Bitcoin Wiki 8. A.M. Antonopoulos, G. Wood , Mastering Ethereum: Building Smart Contracts and DApps O'Reilly Media, 2018 9. A.M. Antonopoulos , Mastering Bitcoin , O'Reilly Media, 2017 10. A. Bahga, V. Madisetti , Blockchain Applications: A Hands-On Approach, VPT Publishing House, 2017 11. Solidity: https://solidity.readthedocs.io/en/v0.5.10/ 12. Burton, David, Elementary Number Theory, 2008, McGraw-Hill Science. 13. Rose, Kenneth, Elementary Number Theory and its Applications, 2010, Pearson. 14. Scheiner, Bruce, Applied Cryptography, 2015, Wiley. 15. Dannen, Chris. Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programming for Beginners.2022 16. Henning Diedrich, Blockchains, Digit Assests, Smart Contracts, Decentralized Autonomous Organzations, 2019		

8.2 Laboratory	Teaching methods	Remarks
1. Configuration of Ethereum client	Conversation, debate, case studies, examples	
2. Tools:Ganache, Remix, Mcrypto	Conversation, debate, case studies, examples	
3. Solidity	Conversation, debate, case studies, examples	
4. Metatask	Conversation, debate, case studies, examples	
5. Java Script	Conversation, debate, case studies, examples	
6. Decentralized Applications	Conversation, debate, case studies, examples	
7. Security	Conversation, debate, case studies, examples	
1.1 Project	Teaching method9*	
1. Project allocation	Conversation, debate, case studies, examples	
2. Requirements Analysis	Conversation, debate, case studies, examples	
3. Solidity	Conversation, debate, case studies, examples	
4. Solidity: design patterns	Conversation, debate, case studies, examples	
5. Decentralized Applications:	Conversation, debate, case studies, examples	
6. Decentralized Applications: advanced topics	Conversation, debate, case studies, examples	
7. Security	Conversation, debate, case studies, examples	
8. Security: advanced topics	Conversation, debate, case studies, examples	

9. Optimizations	Conversation, debate, case studies, examples	
10. Optimizations: advanced topics	Conversation, debate, case studies, examples	
11. Testing	Conversation, debate, case studies, examples	
12. Verification	Conversation, debate, case studies, examples	
13. Project presentation	Conversation, debate, case studies, examples	
14. Project evaluation	Conversation, debate, case studies, examples	
Bibliography 1. Jeremy Clark , an extensive online bibliography of Bitcoin research papers 2. Bitcoin Developer Reference 3. Satoshi Nakamoto , Bitcoin: A Peer-to-Peer Electronic Cash System 4. Ethereum extensive wiki 5. Bitcoin Wiki 6. A.M. Antonopoulos, G. Wood , Mastering Ethereum: Building Smart Contracts and DApps O'Reilly Media, 2018 7. A.M. Antonopoulos , Mastering Bitcoin , O'Reilly Media, 2017 8. A. Bahga, V. Madisetti , Blockchain Applications: A Hands-On Approach, VPT Publishing House, 2017 9. Solidity: https://solidity.readthedocs.io/en/v0.5.10/ 10 Burton, David, Elementary Number Theory, 2008, McGraw-Hill Science. 11 Rose, Kenneth, Elementary Number Theory and its		

Applications, 2010, Pearson.
12. Scheiner, Bruce, Applied Cryptography, 2015, Wiley.
13. Dannen, Chris. Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programming for Beginners.2022
14. Henning Diedrich, Blockchains, Digit Assests, Smart Contracts, Decentralized Autonomous Organzations, 2019

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The course respects the IEEE and ACM Curriculla Recommendations for Computer Science studies;
- The content of the course is considered by the software companies as important for average software development skills

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	know the basic principle of the domain; - apply the course concepts - problem solving	Written final exam	50%
10.5 Seminar/lab activities	be able to use course concepts in solving the real problems	Practical Assignments	50%
10.6 Minimum performance standards			
At least grade 5 (from a scale of 1 to 10) at written final exam and at each laboratory assignment.			

Date	Signature of course coordinator	Signature of seminar coordinator
May 2022	Assoc. Prof. Eng. Florin Craciun	Assoc. Prof. Eng. Florin Craciun

Date of approval

Signature of the head of department

Prof. dr. Laura Dioşan

24.05.2022