COURSE DESCRIPTION FORM: CS-4049 Introduction to Blockchain and Cryptocurrency

INSTITUTION: FAST School of Computing, National University of Computer and Emerging Sciences, Islamabad

PROGRAMS TO BE EVALUATED Computer Science (BS) – Fall 2025

Course Description

Course Code	CS-4049
Course Title	Introduction to Blockchain and Cryptocurrency
Credit Hours	3
Prerequisites by Course(s) and Topics	Data Structures
Grading Policy	Absolute grading (Sections A and B)
Policy about missed assessment items in the course	Retake of missed assessment items (other than midterm/ final exam) will not be held. For a missed midterm/ final exam, an exam retake/ pretake application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee decide the exam retake/ pretake cases.
Course Plagiarism Policy	Plagiarism in an assignment will result in zero marks in the **whole** assignments category. Plagiarism in the course project will result in zero marks in the project and also the deduction of -75% of the total marks for the assessment from other evaluations. For instance, plagiarism in the course project having 10 absolutes would result in 0 points for the project and -7.5 absolutes would be deducted from achieved scores in other assessment items. Plagiarism in the midterm and the final exam would result in a disciplinary case forwarded to the department disciplinary committee.
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	**100% Theory**
Course Instructors	Dr. Sayed Qaiser Ali Shah

Assessment Item	**Number**	**Weight (%)**
Assignments	4-5	25
Quizzes/Activities	6~8	10
Sessional 1	1	12.5
Sessional 2	1	12.5
Final Exam	1	40

Lab Instructors (if	

any)	
Course Coordinator	Dr. Sayed Qaiser Ali Shah
URL (if any)	
Current Catalog Description	The course covers all aspects of Blockchain and Cryptocurrencies, including distributed consensus, smart contracts and different platforms. We will also focus in detail on Bitcoin and Ethereum as case studies.
Textbook (or **Laboratory Manual** for Laboratory Courses)	Distributed Systems: Principles and Paradigms by Andrew S. Tanenbaum and Maarten Van Steen (Authors). Originally Published in 2002. Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications by Imran Bashir (Author). Originally Published in 2017. Blockchain Basics: A Non-Technical Introduction in 25 Steps by Daniel Drescher (Author). Originally Published in 2017. Mastering Bitcoin: Unlocking Digital Cryptocurrencies by Andreas M. Antonopoulos (Author). Originally Published in 2014. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction by Arvind Narayanan (Author), Joseph Bonneau (Author), Edward Felten (Author), Andrew Miller (Author), Steven Goldfeder (Author). Originally Published in 2016 Mastering Ethereum: Building Smart Contracts and DApps by Andreas M. Antonopoulos (Author) and Gavin Wood (Author). Originally Published in 2018.
Reference Material	Blockchain Technology Explained: The Ultimate Beginner's Guide About Blockchain Wallet, Mining, Bitcoin, Ethereum, Litecoin, Zcash, Monero, Ripple, Dash, IOTA, and Smart Contracts by Alan T. Norman (Author). Originally Published in 2017. Bitcoin Developer Guide by Bitcoin.org. Bitcoin and Cryptocurrency Technologies – A Course Offered by Princeton University. Solidity Documentation and Tutorials by Ethereum.org.
Course Learning Outcomes	**A. Course Learning Outcomes (CLOs)** At the completion of the course, the students shall be able to: 1. Identify key components behind the design of blockchain and to understand the types of applications that best fit the model of blockchain 2. Understand why blockchain is considered "secure" and "immutable" and the design of bitcoin and other cryptocurrencies 3. Apply blockchain consensus mechanisms to design and simulate secure peer-to-peer transactions in a cryptocurrency environment

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	✔
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
3. Design/ Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔
4. Investigation & Experimentation	Conduct investigation of complex computing problems using research-based knowledge and research based methods.	
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	✔
6. Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
7. Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems.	
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	
9. Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	
10. Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
11. Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
12. Lifelong Learning	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C. Mapping of CLOs on PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcom

		PLOs											
		1	2	3	4	5	6	7	8	9	10	11	12
CLOs	1	✔	✔	✔									
	2	✔	✔	✔									
	3	✔	✔	✔		✔							

Topics covered in the course with number of lectures on each topic (assume 15 weeks of instruction and 1.5 hour lecture duration)

Topics	Lectures
Introduction to Blockchain	1
Introduction to Cryptocurrencies	2
Cryptographic Hash Functions	2
Hash Pointers and Data structures	4
Bitcoin mechanics and internals	2
Consensus	2
Ethereum and Smart contracts	2

Laboratory Projects/Experiments Done in the Course

Programming Assignments Done in the Course

Programming assignments are related to problem solving, design and analysis of algorithms, choice of appropriate data structures

Class Time Spent per Week (in percentage)

Theory (%)	Problem Analysis (%)	Solution Design (%)	Social and Ethical Issues (%)
50	25	20	5

Oral and Written Communications

Every student is required to submit at least __4____written reports of typically _5_ pages and make __0____oral presentation of typically _____N/A____minutes' duration.

COURSE CONTENTS (Theory):			
Weeks	**Contents/Topics**	****Courseware Events** (MM/ IT Lab/Case Study/ Assignment/ Presentation etc.)	**Comments (if any)** **Text Book Topic**
Week-01	Course Introduction, History and Evolution of Money		
Week-02	History of Blockchain, Properties of Blockchain, Go Language	Assignment-01	
Week-03	Byzantine General Problem and Proof of Work Consensus Algorithm		
Week-04	Mechanics of Bitcoin		
Week-05	Blockchain Key Pairs (Public Key Cryptography)		
Week-06	Wallets and Introduction to Ethereum Platform		
Week-07	Solidity Language		
Week-08	Smart Contracts		
Week-09	Decentralized Applications (DApss)	Assignment-2 (DApp)	
Week-10	Proof of Stake Consensus Algorithm and Delegated Proof of Stake Consensus		
Week-11	Sharding, Side Chain (Layer-2 Solutions) and Rollups		
Week -12	On-chain and Off-chain, InterPlanetary File System (IPFS)	Assignment-3 (IPFS)	

Week -13	ZK-SNARKs, Cross Chain		
Week -14	Cryptocurrency	Assignment-4 (Trading and Bots Assignment)	
Week -15	Token Standards (ERC-20 and NFTs ERC-721), Security attacks and Mitigations in Blockchain	Assignment-5 (NFT Marketplace)	
Week -16	Permissioned Blockchain and PoA		