

Lesson Plan

B.E. (CE-B) (Semester VII)

Subject: Blockchain Technology

Subject code: CSDC7022

Teacher-in-charge: Prof. Monica Khanore

Academic Term: July – October 2022

Module		Content	Hrs
1		Introduction to Blockchain	6
	1.1	What is a blockchain, Origin of blockchain (cryptographically secure hash functions), Foundation of blockchain: Merkle trees	
	1.2	Components of blockchain, Block in blockchain, Types: Public, Private, and Consortium, Consensus Protocol, Limitations and Challenges of blockchain	
2		Cryptocurrency	6
	2.1	Cryptocurrency: Bitcoin, Altcoin, and Tokens (Utility and Security), Cryptocurrency wallets: Hot and cold wallets, Cryptocurrency usage, Transactions in Blockchain, UTXO and double spending problem	
	2.2	Bitcoin blockchain: Consensus in Bitcoin, Proof-of-Work (PoW), Proof-of-Burn (PoB), Proof-of-Stake (PoS), and Proof-of-Elapsed Time (PoET), Life of a miner, Mining difficulty, Mining pool and its methods	
3		Programming for Blockchain	8
	3.1	Introduction to Smart Contracts, Types of Smart Contracts, Structure of a Smart Contract, Smart Contract Approaches, Limitations of Smart Contracts	
	3.2	Introduction to Programming: Solidity Programming – Basics, functions, Visibility and Activity Qualifiers, Address and Address Payable, Bytes and Enums, Arrays-Fixed and Dynamic Arrays, Special Arrays-Bytes and strings, Struct, Mapping, Inheritance, Error handling	
	3.3	Case Study – Voting Contract App, Preparing for smart contract development	

4		Public Blockchain	8
		Introduction to Public Blockchain, Ethereum and its Components, Mining in Ethereum, Ethereum Virtual Machine (EVM), Transaction, Accounts, Architecture and Workflow, Comparison between Bitcoin and Ethereum	
		Types of test-networks used in Ethereum, Transferring Ethers using Metamask, Mist Wallet, Ethereum frameworks, Case study of Ganache for Ethereum blockchain. Exploring etherscan.io and ether block structure	
5		Private Blockchain	8
	5.1	Introduction, Key characteristics, Need of Private Blockchain, Smart Contract in a Private Environment, State Machine Replication, Consensus Algorithms for Private Blockchain - PAXOS and RAFT, Byzantine Faults: Byzantine Fault Tolerant (BFT) and Practical BFT	
	5.2	Introduction to Hyperledger, Tools and Frameworks, Hyperledger Fabric, Comparison between Hyperledger Fabric & Other Technologies	
	5.3	Hyperledger Fabric Architecture, Components of Hyperledger Fabric: MSP, Chain Codes, Transaction Flow, Working of Hyperledger Fabric, Creating Hyperledger Network, Case Study of Supply Chain Management using Hyperledger	
6		Tools and Applications of Blockchain	3
		Corda, Ripple, Quorum and other Emerging Blockchain Platforms, Blockchain in DeFi: Case Study on any of the Blockchain Platforms.	

Course Objectives:

1. To understand blockchain platforms and its terminologies.
2. To understand the use of cryptography required for blockchain.
3. To understand smart contracts, wallets, and consensus protocols.
4. To design and develop blockchain applications.

Course Outcomes:

Upon completion of this course students will be able to:

- CSDC7022.1: Explain Blockchain concepts.
- CSDC7022.2: Associate knowledge of consensus and mining in blockchain.
- CSDC7022.3: Apply the concepts of smart contract for an application.
- CSDC7022.4: Explore Hyperledger Fabric and its working.
- CSDC7022.5: Explain design principles of Ethereum.
- CSDC7022.6: Analyse various tools of BCT.

CO-PO-PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSDC7022.1	1													
CSDC7022.2	1													2
CSDC7022.3		2			1									
CSDC7022.4	1													
CSDC7022.5	2													
CSDC7022.6	1													

CO Assessment Tools:

<i>Course Outcomes</i>	<i>Indirect Method (20%)</i>							
	Unit Tests		Assignments		Quizzes		End Sem Exam	Course exit survey
	1	2	1	2	1	2		
CSDC7022.1	20%	--	20%	--	10%	--	50%	100%
CSDC7022.2	20%	--	20%	--	10%	--	50%	100%
CSDC7022.3	--	25%	--	25%	10%	--	50%	100%
CSDC7022.4	--	20%	--	20%	--	10%	50%	100%
CSDC7022.5	--	20%	--	20%	--	10%	50%	100%
CSDC7022.6	--	20%	--	20%	--	10%	50%	100%

CO calculation= (0.8 *Direct method + 0.2*Indirect method)

Rubrics for assessing Course Outcome with each assessment tool:

Assignment:

Indicator				
Timeline (2)	More than two days late (0)	Two days late (1)	One day late (2)	On time (3)
Correctness (4)	All questions correct (4)	One point deducted for each incorrect answer		
Completion (4)	All questions answered (4)	One point will be deducted for each incomplete or un-attempted question		

Curriculum Gap identified: (with action plan)

Nil

Content beyond syllabus:

Nil

Modes of content delivery

Modes of Delivery	Brief description of content delivered
Class room lecture	1. Introduction to Blockchain 2. Cryptocurrency 3. Programming for Blockchain 4. Public Blockchain 5. Private Blockchain 6. Tools and Applications of Blockchain
Assignments	Assignment 1: based on 1. Introduction to Blockchain 2. Cryptocurrency Assignment 2: based on remaining modules
Quizzes	Quiz 1: on 1. Introduction to Blockchain 2. Cryptocurrency 3. Programming for Blockchain Quiz 2: on 4. Public Blockchain 5. Private Blockchain 6. Tools and Applications of Blockchain

Text books:

1. Blockchain Technology, Chandramouli Subramanian, Asha A. George, Abhillash K. A and Meena Karthikeyen, Universities Press.
2. Mastering Ethereum, Building Smart Contract and Dapps, Andreas M. Antonopoulos Dr. Gavin Wood, O'reilly.
3. Imran Bashir, Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Packt Publishing.

Reference Books:

1. Blockchain for Beginners, Yathish R and Tejaswini N, SPD
2. Blockchain Basics, A non-Technical Introduction in 25 Steps, Daniel Drescher, Apress
3. Blockchain with Hyperledger Fabric, Luc Desrosiers, Nitin Gaur, Salman A. Baset, Venkatraman Ramakrishna, Packt Publishing

Lesson Plan

CLASS		BE Computer Engineering (B), Semester VII			
Academic Term		July- October 2022			
Subject		Blockchain Technology (CSDC7022)			
<i>Periods (Hours) per week</i>		<i>Lecture</i>		3	
		<i>Practical</i>			
		<i>Tutorial</i>			
<i>Evaluation System</i>				<i>Hours</i>	<i>Marks</i>
		Theory examination		3	80
		Internal Assessment		--	20
		Practical Examination		--	--
		Oral Examination		--	--
		Term work		--	--
		Total		--	100
<i>Time Table</i>		<i>Day</i>		<i>Time</i>	
		Wednesday		8.45-9.45am	
		Thursday		12-1pm	
		Friday		12-1pm	
<i>Course Content and Lesson plan</i>					
Week	Lecture No.	Date		Topic	Remarks
		Planned	Actual		
<i>Module 1: Introduction to Blockchain</i>					
1	1	19-07-22	20-07-22	Syllabus, Introduction to blockchain, Hashing	
	2	20-07-22	22-07-22	Merkle Tree, Origin of blockchain	
2	3	27-07-22	27-07-22	Peer-to-peer network, components of blockchain	
	4	28-07-22	28-07-22	block in blockchain, consensus protocol, how blockchain technology works,	
	5	29-07-22	29-07-22	pros and cons of BCT, Applications of BC, Types of BC	
<i>Module 2: Cryptocurrency</i>					
3	6	03-08-22	03-08-22	Cryptocurrency: wallets: Hot, cold	
	7	04-08-22	04-08-22	cryptocurrency: Altcoin, Tokens: utility, security, Hybrid	
	8	05-08-22	05-08-22	Cryptocurrency usage: players, Ecosystem Cryptomining, Airdrop, Token or Coin burning	
4	9	10-08-22	10-08-22	Cryptocurrency usage: Investment and Trading, Cryptocurrency safety, Regulations around cryptocurrency,	

	10	11-08-22	10-08-22	Consensus Protocols: Objectives of consensus protocols, PoW, PoS, PoB, PoET	
	11	12-08-22	11-08-22 12-08-22	Transactions in blockchain, UTXOs, Double-spending problem	
5	12	17-08-22	12-08-22 17-08-22	Cryptocurrency difficulty, Mining pools and their methods, Lifespan of a miner	
Module 3: Programming for Blockchain					
	13	18-08-22	17-08-22 18-08-22	Smart Contracts intro, how SC works, Types of Smart Contracts	Assignment 1 on Module 1&2
	14	19-08-22	24-08-22	Structure of a Smart Contract, Limitations of Smart Contracts, Solidity: Functions	
6	15	24-08-22	24-08-22 25-08-22	Solidity: Fixed sized arrays, Dynamic-sized arrays Structures	
	16	25-08-22	25-08-22 26-08-22	Bytes, String arrays, Memory and Storage	
	17	26-08-22	26-09-22	Enum, mapping, error Handling	
7					Holidays from 31/08 to 04/09 due to Ganesh Festival
Module 5: Public Blockchain					
8	18	08-09-22	07-09-22	Introduction to Public Blockchain, Ethereum and its Components	UT1: 05/09, 06/09, 07/09/2022 Test postponed to 14-16/09/22 Classes on 08/09 cancelled due to placement
	19	09-09-22	21-09-22	Mining in Ethereum, Ethereum Virtual Machine (EVM), Transactions	Holiday: Anant Chaturdashi
9	20	14-09-22	22-09-22	Accounts, Architecture and Workflow, Comparison between Bitcoin and Ethereum	Quiz 1 on Modules 1-3
	21	15-09-22	23-09-22	Types of test-networks used in Ethereum	
Module 6: Private Blockchain					
	22	16-09-22	23-09-22	key characteristics, Smart Contract in a Private Environment	
10	23	21-09-22	23-09-22 28-09-22	State Machine Replication, Consensus Algorithms for Private Blockchain - PAXOS	
	24	22-09-22	29-09-22	RAFT algorithm, Byzantine Faults	
	25	23-09-22	30-09-22	Byzantine Fault Tolerant (BFT), Practical BFT	
11	26	28-09-22	06-10-22	Hyperledger: Tools and frameworks	
	27	29-09-22	06-10-22 07-10-22	Hyperledger fabric, comparison between Hyperledger fabric and other technologies	
	28	30-09-22	12-10-22	Hyperledger fabric architecture,	
12	29	06-10-22	13-10-22	Components of Hyperledger Fabric: MSP, Chain Codes, Transaction Flow	
	30	07-10-22	14-10-22	Working of Hyperledger Fabric, case study of Supply chain management using Hyperledger Case Study of Supply Chain Management using	
Module 4: Tools and Applications of Blockchain					
	31	12-10-22		Corda, Ripple	Assignment 2 on modules 3-6

13	32	13-10-22		Quorum	Topics could not be completed due to shortage of classes. Reference books posted on Google classroom
	33	14-10-22		Blockchain in DeFi	
14					UT2 during 17-19/10/2022 Quiz 2 on Modules 4-6
Total	33				

Submitted By	Approved By
Prof. Monica Khanore	ii) Dr. Sujata Deshmukh Sign:
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	iii) Prof. Merly Thomas Sign:
	iv) Prof. Roshni Padate Sign:
	v) Prof. Kalpana Deorukhkar Sign:
Date of Submission:	Date of Approval:
Remarks by DQAC (if any)	