Lesson Plan

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

Subject: Blockchain Technology

Subject code: CSDC7022

Teacher-in-charge: Prof. Monali Shetty

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 contact for an application.
CSDC7022.4: Explore Hyperledger Fabric and its working.
CSDC7022.5: Explain design principles of Ethereum.
CSDC7022.6: Analyze 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:

Course Outcomes	*Indirect Method (20%)*							
	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:

Expert Session on " Future Opportunities in Blockchain Technology"	12-10-22	PO1(1.4.1),PO12 (12.2.1, 12.2.2)		Online platform

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. AntonopoulosDr. 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 (A), Semester VII
Academic Term	July- October 2022
Subject	**Blockchain Technology (CSDC7022)**

Periods (Hours) per week		*Lecture*	3
		Practical	
		Tutorial	

Evaluation System		*Hours*	*Marks*
	Theory examination	3	80
	Internal Assessment	--	20
	Practical Examination	--	--
	Oral Examination	--	--
	Term work	--	--
	Total	--	100

Time Table	*Day*	*Time*
	Tuesday	12-1-1 pm
	Wednesday	11-12 pm
	Friday	1.30-2.30pm

Course Content and Lesson plan

Week	Lecture No.	Date Planned	Date Actual	Topic	Remarks
		Module 1: Introduction to Blockchain			
1	1	19-07-22	19-07-22	Syllabus, Introduction to blockchain, Hashing	
	2	21-07-22	21-07-22	Merkle Tree, Origin of blockchain	
2	3	22-07-22	22-07-22	Peer-to-peer network, components of blockchain	
	4	27-07-22	27-07-22	block in blockchain, consensus protocol, how blockchain technology works,	
	5	28-07-22	28-07-22	pros and cons of BCT, Applications of BC, Types of BC	
		Module 2: Cryptocurrency			
3	6	29-07-22	29-07-22	Cryptocurrency: wallets: Hot, cold	
	7	2-08-22	02-08-22	cryptocurrency: Altcoin, Tokens: utility, security, Hybrid	
	8	3-08-22	03-08-22	Cryptocurrency usage: players, Ecosystem Cryptomining, Airdrop, Token or Coin burning	
4	9	5-08-22	5-08-22	Cryptocurrency usage: Investment and Trading, Cryptocurrency safety, Regulations around cryptocurrency,	

	10	10-08-22	10-08-22 12-08-22	Consensus Protocols: Objectives of consensus protocols, PoW, PoS, PoB, PoET	
	11	12-08-22	18-08-22	Transactions in blockchain, UTXOs, Double-spending problem	
5	12	18-08-22	23-8-22	Cryptocurrency difficulty, Mining pools and their methods, Lifespan of a miner	
				Module 3: Programming for Blockchain	
	13	23-08-22(2)	23-8-22(Extra Lec)	Smart Contracts intro, how SC works, Types of Smart Contracts	Assignment 1 on Module 1&2
	14	24-08-22	24-08-22	Structure of a Smart Contract, Limitations of Smart Contracts, Solidity: Functions	
6	15	30-08-22	30-8-22	Solidity: Fixed sized arrays, Dynamic-sized arrays Structures	
	16	6-09-22	6-9-22	Bytes, String arrays, Memory and Storage	
	17	7-09-22	7-09-22	Enum, mapping, error Handling	
7					Holidays from 31/08 to 04/09 due to Ganesh Festival
8				*Module 5: Public Blockchain*	
	18	13-09-22	13-09-22	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	20-09-22	20-09-22	Mining in Ethereum, Ethereum Virtual Machine (EVM), Transactions	Holiday: Anant Chaturdashi
9	20	21-09-22	21-09-22	Accounts, Architecture and Workflow, Comparison between Bitcoin and Ethereum	Quiz 1 on Modules 1-3
	21	25-09-22	25-09-22	Types of test-networks used in Ethereum	
				Module 6: Private Blockchain	
	22	26-09-22	26-09-22	key characteristics, Smart Contract in a Private Environment	
10	23	28-9-22	28-09-22	State Machine Replication, Consensus Algorithms for Private Blockchain - PAXOS	
	24	4-10-22	4-10-22	RAFT algorithm, Byzantine Faults	
	25	7-10-22	7-10-22	Byzantine Fault Tolerant (BFT), Practical BFT	
11	26	8-10-22	8-10-22	Hyperledger: Tools and frameworks	
	27	11-10-22	11-10-22	Hyperledger fabric, comparison between Hyperledger fabric and other technologies	
	28	12-10-22	12-10-22	Hyperledger fabric architecture,	
12	29	14-10-22	14-10-22	Components of Hyperledger Fabric: MSP, Chain Codes, Transaction Flow	
				Module 4: Tools and Applications of Blockchain	
	30	21-10-22	21-10-22	Corda, Ripple, Quorum	Assignment 2 on modules 3-6 UT2 during 17-19/10/2022Quiz 2 on Modules 4-6
Total	30				

Submitted By	Approved By	
Prof. Monali Shetty	ii) Dr. Sujata Deshmukh	Sign:
Sign:	ii) Dr. B. S. Daga	Sign:
	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)		