GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Information Technology

Subject Code : ME02023081

Subject Name : Blockchain Technologies and Applications – Decentralization and smart contracts

WEF Academic Year :	2024-25
Semester :	2
Category of the Course :	Professional Elective Course

Prerequisite :	Data structure
Rationale :	Traditional database technologies poses several challenges for recording transactions. Blockchain creates a decentralized, tamper-proof system to record transactions. Blockchain is an irreversible record of transactions, which cannot be changed, none of the transaction can be deleted or destroyed. Blockchain is used in the creation of various cryptocurrencies, decentralized finance applications, non-fungible tokens and smart contracts.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level*
01	Describe the Blockchain and Bitcoin structure , Types of Blockchain, consensus mechanism and challenges in Blockchain.	UN
02	Use Ethereum and Solidity for creating Blockchain and smart contract with the use of IPFS	UN
03	Apply the Blockchain concepts to real world application	AP

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Teaching and Examination Scheme :

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

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Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1.	The Growth of Blockchain Technology, Distributed systems, The history of Blockchain and Bitcoin, Generic elements of Blockchain, Benefits and limitations of Blockchain,Tiers of Blockchain technology, Features of Blockchain Types of Blockchain Distributed ledgers, Public Blockchain, Private Blockchain, shared ledger, Fully private and proprietary Blockchain, Tokenized and Tokenless Blockchain Consensus Mechanism, types of consensus, consensus in Blockchain	8	20
2	Decentralization using Blockchain Methods of decentralization, routes to decentralization, Blockchain and full eco system decentralization, smart contracts, Decentralized organizations, Ethereum, Maidsafe, Lisk Introducing Bitcoin, Bitcoin - Digital keys and addresses, Bitcoin - Transactions, Bitcoin -Blockchain, Bitcoin -Mining, Bitcoin -Wallets, Bitcoin -Payments	9	30
3	Ethereum, smart contracts, DApps Ethereum's components, Ethereum and DApps, Ethereum clients, Ethereum networks, Geth, synchronizing the Testnet, Smart contracts and Solidity, DApps using Ethereum, Backend of the App, Ganache, Decentralized message communication protocol Decentralized Databases – OrbitDB Decentralized Apps and Frameworks - OpenBazaar	10	20
4	Interplanetary file system Working of IPFS, content based addressing, Directed acyclic graph, Distributed Hash table, Installing and configuring IPFS	8	10
5	Scalability and Other challenges Scalability – Network plane, consensus plane, storage plane, view plane, Block size increase, Block interval reduction, Invertible Bloom Lookup table, Sharding, state channels, Proof of stake, Sidechains	10	20

	Privacy Indistinguishable Obfuscation, Homomorphic encryption, Zero knowledge Proofs, state channels, secure multiparty computation, Usage of hardware for confidentiality, Confidential transactions, MimbleWimble, Smart contract security		
	Total	**45**	**100**

Reference Book:

1) Building Decentralized Blockchain Applications: By Shahid Shaikh,BPB publication
2) Mastering Blockchain By Imran Bashir, Packt> publication
3) The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing, and Securing Distributed Blockchain-based Projects Paperback by Elad Elrom, Apress publication

Suggested Course Practical List:

1. Create a Blockchain for the students of class ME sem 2 to keep track of their ME scorecard. Integrate IPFS to store the data.
2. Analyze any Fintech platform to check the implementation of Blockchain and write the case study.
3. Develop a blockchain-based voting system. When a vote is saved in the blockchain, it should be tracked in real time, and it can never be changed.
4. Write a smart contract in which anyone can deposit ether in owner's account but only owner can withdraw the ether.
5. Develop a crowd funding problem in which a user wants to generate fund of 20000 currencies for Green Energy project. Develop wallet which takes the funds and when the 20000 fund is received, it generates the message that " Funding achieved"
6. Develop a smart contract in supply chain management, to track the movement of goods and ensure that they meet quality standards before payment is released.

List of Laboratory/Learning Resources Required:

1) Desktop Computers, Laptop
2) https://remix.ethereum.org/#lang=en&optimize=false&runs=200&evmVersion=null
3) https://ethereum.org/en/

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