No:-   Date:

CSX4214   Blockchain Technology

L-T-P-Cr: 3-0-0-3

Pre-requisites: Expertise in Programming, Basic Knowledge of Computer Security, Cryptography, Networking, Computer Systems Security

Objectives/Overview:
● To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers.
● To understand the structure of a blockchain and why/when it is better than a simple distributed database
● To make students understand the technological underpinnings of blockchain operations as distributed data structures and decision making systems.
● To understand a "smart" contract and its legal implications.
● To provide a critical evaluation of existing "smart contract" capabilities and platforms, and examine their future directions, opportunities, risks and challenges.

Course Outcomes:

Upon completion of this course, students will be:

S.NO	Outcome	Level of Attainment
CO-1	Able to design smart contracts and decentralized applications.	Usage
CO-2	Able to understand Distributed Ledger Technologies and apply this concept in real world.	Usage
CO-3	Able to design innovative application models using the Blockchain technology.	Usage
CO-4	Able to understand core concepts of Blockchain technology that are commonly used across multiple industries to solve large scale problems.	Familiarity

Course Outcomes–Cognitive Levels–Program Outcomes Matrix –
[H: High relation (3); M: Moderate relation (2); L: Low relation (1)]

Course Outcomes	Program Outcomes											
	PO-1 (Engineering knowledge)	PO-2 (Problem analysis)	PO-3 (Design/ development of solutions)	PO-4 (Conduct investigations of complex problems)	PO-5 (Modern tool usage)	PO-6 (The engineer and society)	PO-7 (Environment and sustainability)	PO-8 (Ethics)	PO-9 (Individual and team work)	PO-10 (Communication)	PO-11 (Project management and finance)	PO-12 (Life-long learning)
CO-1	H	H	H	M	H	M	H	H	L	H	H	M
CO-2	H	M	H	M	H	H	H	M	L	M	H	H
CO-3	H	M	H	L	H	H	H	M	M	M	H	H
CO-4	H	H	L	H	H	H	H	M	M	H	H	H

UNIT I: **Lectures: 6**
Introduction to Blockchain, Structure of a Block, Types of Blockchain, Public Ledgers, Blockchain as public ledgers, Cryptocurrency as application of blockchain technology

UNIT II: **Lectures: 8**
Basic Cryptographic primitives used in Blockchain – Secure, Collision-resistant hash functions, Digital signature, Public key cryptosystems, Zero-knowledge proof systemsCryptographic Hash Function, SHA-256,Properties of a hash function, Hash pointer and Merkle tree.

UNIT III: **Lectures: 8**
Consensus, Distributed consensus in open environments, Consensus in a Bitcoin network
Types of consensusalgorithm: Proof of Work (PoW), Proof of Stake (PoS), Delegated Proof of Stake (DPoS), Ripple, Proof of Burn

UNIT IV: **Lectures: 6**
Introduction to Bitcoin, History of Bitcoin, Bitcoin Transactions, Bitcoin Mining,Bitcoin Address.

UNIT V: **Lectures: 6**

Introduction to Ethereum - Ethereum Virtual Machine (EVM), Wallets for Ethereum, Differences between Ethereum and Bitcoin, Block format, Mining algorithm, Solidity, Smart Contracts, Some attacks on smart contracts.

UNIT VI: **Lectures: 8**
Blockchain Technology: Hyper ledger Fabric: System architecture, ledger format, chaincode execution, transaction flow and ordering, private channels, membership service providers, Fabric Peer and Certificate Authority,Case studies of applications

Text / Reference Books:
1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos, O'Reilly publisher
2. Blockchain Blueprint for a New Economy,by Melanie Swan, O'Reilly
3. Narayanan, Arvind, et al. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton University Press, 2016.
4. Antonopoulos, Andreas M. Mastering Bitcoin: Programming the Open Blockchain. O'Reilly Media, Inc., 2017
5. Antonopoulos, Andreas M. and Wood, Gavin. Mastering Ethereum. O'Reilly Media, Inc., 2018. (Free draft available at https://github.com/ethereumbook/ethereumbook)
6. Ethereum project documentation. Online: http://www.ethdocs.org/en/latest/
7. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
8. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
9. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric