NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Technology**
Name of Programme:	**BTech CSE**
Course Code:	4CS204ME25
Course Title:	**Blockchain Technology**
Course Type:	**Department Elective-IV**
Year of Introduction:	**2025-26**

L	T	Practical Component				C
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Course Learning Outcomes (CLO):

At the end of the course, the students will be able to –

1. summarize the concept of Blockchain technology (BL2)
2. evaluate security issues relating to Blockchain and cryptocurrency (BL5)
3. develop the structure of a Blockchain network (BL5)
4. design the applications based on Blockchain technology (BL6)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	**Introduction to Blockchain:** Blockchain 1.0 to 5.0, types of blockchain, Generic elements of a blockchain, digital money to distributed ledgers, design primitives, protocols, security, consensus, permissions, and privacy.	06
Unit-II	**Blockchain Architecture, Design, and Consensus**: Basic crypto primitives: hash, signature, hash chain to Blockchain, basic consensus mechanisms, requirements for the consensus protocol for permissionless environment, PoW, PoS, PoB, PoET, and scalability aspects of Blockchain consensus protocols.	08
Unit-III	**Permissioned and Public Blockchains**: Design goals, Consensus protocols for Permissioned Blockchains, Hyperledger Fabric, Decomposing the consensus process, Hyperledger fabric components, Smart Contracts, Chain code design, Hybrid models (PoS and PoW)	08
Unit-IV	**Blockchain cryptography**: Different techniques for Blockchain cryptography, privacy and security of Blockchain, multi-sig concept	08
Unit-V	**Blockchain Interoperability:** Blockchain Interoperability, Interoperability Protocols and Standards, Cross-Chain Communication Mechanisms, Interoperability Solutions and Technologies, Case Studies and Real-World Applications	09
Unit-VI	**Recent trends and research issues in Blockchain**: Scalability, secure cryptographic protocols on Blockchain, multiparty communication, Adoption of blockchain technology in various applications.	06

Self-Study:

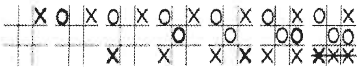
The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Suggested Readings/ References:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, *Bitcoin and cryptocurrency technologies: a comprehensive introduction.* Princeton University Press.
2. Wattenhofer, Roger, *The science of the blockchain*, CreateSpace Independent Publishing Platform
3. Bahga, Arshdeep, and Vijay Madisetti, *Blockchain Applications: A Hands-on Approach*, VPT
4. Nakamoto, Satoshi, *Bitcoin: A peer-to-peer electronic cash system*, Research Paper
5. Antonopoulos, Andreas M, *Mastering Bitcoin: Programming the open blockchain*, O'Reilly Media, Inc
6. Diedrich, Henning, *Ethereum: Blockchains, digital assets, smart contracts, decentralized autonomous organizations*, Wildfire Publishing
7. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, *Blockchain Technology: Cryptocurrency and Applications*, Oxford University Press
8. Josh Thompson, *Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming,* Create Space Independent Publishing Platform

Suggested List of Experiments:

Sr. No.	Name of Experiments/Exercises	Hours
1	Implement digital signatures to sign and verify authenticated users. Also, show a message when tampering is detected.	02
2	To create a blockchain and implement replay attacks on the blockchain.	04
3	To perform a thorough study and installation of Anaconda and Python, and perform proof of work (POW) consensus mechanism. Also, notice the changes in mining rewards and nonce requirements.	02
4	To create a cryptocurrency and implement Byzantine Generals Problem in Python.	04
5	To perform thorough study and installation of Remix IDE and Truffle IDE for deploying Smart Contracts and Decentralized Applications (DApps) and create and deploy a Smart Contract for any application such as finance, healthcare, etc.	02
6	To build, implement, and test voting mechanisms using Ethereum Blockchain. First, list the contestants on the screen and the votes they got. Whenever the user tries to vote for a particular contestant, the count of the votes for the particular contestant should increase by 1. Also, the user who has already voted should be marked. Marked means "the user has already voted once and will not be allowed to vote again".	04
7	To perform a thorough study of blockchain development on Hyperledger Fabric using Composer	02
8	To design and develop end-to-end decentralized applications (DApps).	04

9	To write a Solidity contract that implements a distributed ticket sales system. Anybody can create an event (specifying the initial price and number of tickets). Anybody can then purchase one of the initial tickets or sell those tickets peer-to-peer. At the event, gate agents will check that each attendee is listed in the final attendees' list on the blockchain. (Ethereum programming)	02
10	To write a contract code to implement a two-player game (with a wager on the line) of Tic-Tac-Toe, also known as Noughts and Crosses: (Ethereum programming) 	04