

Course Objective:

- To understand the fundamental principles of blockchain technology and its decentralized architecture, including cryptography, consensus mechanisms, and distributed ledgers.
- To explore the practical applications of blockchain across various domains such as finance, supply chain management, healthcare, and smart contracts.
- To equip students with the skills to develop and deploy blockchain-based solutions using tools and platforms like Ethereum, Hyperledger, and Solidity.

Module 1 (10hrs)

Introduction to blockchain technology, History and Evolution of Blockchain, Basic Concepts of Blockchain: Distributed Ledger Technology (DLT), Peer-to-Peer Network, Cryptography Fundamentals: Hashing, Public and Private Key, Types of Blockchains: Public, Private, and Consortium Blockchains, Key differences and use cases

Module 2 (10hrs)

Blockchain Structure : Blocks, Transactions, and Merkle Trees, Block Structure: Header, Body, Linking Blocks through Hashes, Consensus Algorithms: Proof of Work (PoW), Proof of Stake (PoS), Delegated Proof of Stake (DPoS), Practical Byzantine Fault Tolerance (PBFT), Comparing consensus algorithms: performance, scalability, energy consumption, Smart Contracts and DApps : Introduction to Smart Contracts, Ethereum and Solidity Programming, Decentralized Applications (DApps) – Use cases and development

Module 3 (10hrs)

Popular Blockchain Platforms: Bitcoin, Ethereum, Hyperledger Fabric, Corda, Comparative study of different platforms and their applications, Blockchain Development Tools, Remix IDE, Ganache, Truffle, MetaMask, Creating and deploying smart contracts on Ethereum, Interoperability and Scalability: Challenges in blockchain scalability, Cross-chain interoperability solutions

Module 4 (10hrs)

Applications in Various Domains: Financial Services: Cryptocurrency, Digital Payments, and DeFi, Supply Chain Management, Healthcare, and Real Estate, Internet of Things (IoT) and Blockchain Integration, Government Services: Digital Identity and Voting Systems, Challenges and Limitations: Security and Privacy Concerns, Regulatory and Legal Issues, Energy Efficiency and Environmental Impact, Future Trends: Blockchain in AI and Machine Learning, Web3 and the Decentralized Web, Central Bank Digital Currencies (CBDCs)

Text Books:

- "Mastering Blockchain" by Imran Bashir
- "Blockchain Basics" by Daniel Drescher
- "Blockchain Revolution" by Don Tapscott and Alex Tapscott

Course Outcomes (COs):

- CO1: Understand the fundamental principles and key components of blockchain technology, including cryptography, distributed ledger technology, and peer-to-peer networks.
- CO2: Analyze different types of blockchain architectures and consensus algorithms (PoW, PoS, DPoS, PBFT) and assess their performance in terms of scalability, security, and energy efficiency.
- CO3: Develop and deploy blockchain-based solutions using Ethereum, Hyperledger, and Solidity, including the creation of smart contracts and decentralized applications (DApps).
- CO4: Evaluate the role of blockchain in various industries such as finance, supply chain management, healthcare, and government services, addressing challenges like privacy, security, and regulatory issues.
- CO5: Explore future trends in blockchain technology, including its integration with AI, machine learning, IoT, and emerging innovations like Central Bank Digital Currencies (CBDCs) and Web3