SBIT TECHMENTORS CURRICULUM BLOCKCHAINS, TOKENS AND DISTRIBUTED LEDGER

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BLOCKCHAINS, TOKENS AND DISTRIBUTED LEDGER

This program provides a comprehensive exploration of blockchain technology, digital tokens, and distributed ledger systems. It covers the foundational principles of decentralized networks, the mechanics of blockchain architecture, consensus mechanisms, and the application of tokens in decentralized finance (DeFi). The course also examines smart contracts, governance models, and explores the regulatory and ethical implications of blockchain technology. Students will gain hands-on experience in building, deploying, and managing blockchain-based applications and understanding the future potential of these technologies across industries.

SCHEME

Course Name: Blockchains, Tokens and Distributed Ledger						
Duration: 9 Months (39 weeks)						
S. No.	**Paper Title**	**Lecture / Tutorial (per week)**	**Practical Classes (per week)**	**Total Hours (Lecture / Tutorial)**	**Total Hours (Practical Classes)**	**Total Credit**
1	Introduction to Blockchain Technology	3	10	20	50	3
2	Blockchain Architecture and Consensus Mechanisms	3	10	20	50	3
3	Tokens and Digital Assets	4	11	26	68	4
4	Smart Contracts and Decentralized Applications (dApps)	3	10	20	50	3
5	Distributed Ledger Technologies (DLTs) Beyond Blockchain	3	10	20	50	3
6	Governance, Regulation, and Ethical Considerations	3	10	26	38	3
7	Capstone Project	1	5	18	144	6
Total				**150**	**450**	**25**

PROGRAM OUTCOMES

- Master the Fundamentals of Blockchain Technology
- Develop and Deploy Blockchain-Based Applications
- Comprehend the Role and Functionality of Digital Tokens
- Explore Distributed Ledger Technologies Beyond Blockchain
- Understand Governance, Regulation, and Ethics in Blockchain Ecosystems
- Solve Real-World Problems Using Blockchain Solutions
- Explore Emerging Trends and Career Opportunities

LEARNING PATH VISUALIZATION

1) Introduction to Blockchain Technology
2) Blockchain Architecture and Consensus Mechanisms
3) Tokens and Digital Assets
4) Smart Contracts and Decentralized Applications (dApps)
5) Distributed Ledger Technologies (DLTs) Beyond Blockchain
6) Governance, Regulation, and Ethical Considerations
7) Capstone Project

MODULE 1: INTRODUCTION TO BLOCKCHAIN TECHNOLOGY

LEARNING OUTCOMES:

- Understand the core concepts and architecture of blockchain.
- Explain how distributed ledgers work and how they differ from traditional databases.
- Grasp the historical context and evolution of blockchain technology.

TOPICS COVERED:

- History and Evolution of Blockchain
  - Trace the origins of blockchain, from the invention of Bitcoin by Satoshi Nakamoto to the emergence of blockchain in various sectors beyond cryptocurrencies.
  - Study key events and milestones that shaped blockchain's development.
- Key Concepts: Distributed Ledger, Decentralization, Consensus
  - Understand how distributed ledger technology (DLT) works and how decentralization ensures security and transparency.
  - Learn about consensus mechanisms that ensure agreement in decentralized networks without a central authority.
- Types of Blockchain: Public, Private, and Consortium
  - Explore the differences between public (open, permissionless) and private (permissioned) blockchains, as well as consortium models used by multiple organizations.
- Bitcoin and the Origin of Blockchain
  - Dive into the origins of Bitcoin as the first use case of blockchain technology and its impact on financial systems.

MODULE 2: BLOCKCHAIN ARCHITECTURE AND CONSENSUS MECHANISMS

LEARNING OUTCOMES:

- Analyze the underlying architecture of blockchain networks.
- Compare various consensus mechanisms and their impact on security and performance.
- Understand blockchain scalability and challenges.

TOPICS COVERED:

- Blockchain Architecture: Blocks, Chains, Nodes, and Networks
  - Learn about the structure of a blockchain, including how blocks of data are chained together and validated by nodes.
  - Explore key components such as hash functions, Merkle trees, and cryptographic signatures.
- Consensus Algorithms: PoW, PoS, DPoS, PBFT
  - Study how different consensus algorithms (Proof of Work, Proof of Stake, Delegated Proof of Stake, and Practical Byzantine Fault Tolerance) are used to achieve agreement among participants in decentralized networks.
- Scalability Issues and Solutions
  - Understand the scalability challenges facing blockchain networks and explore solutions such as sharding, Layer 2 solutions (e.g., Lightning Network), and sidechains.
- Block Time, Mining, and Validation Process
  - Learn how block time affects transaction speed and security and explore the process of mining and validating transactions on the blockchain.

MODULE 3: TOKENS AND DIGITAL ASSETS

LEARNING OUTCOMES:

- Understand the concept of digital tokens and their role within blockchain ecosystems.
- Differentiate between utility tokens, security tokens, and non-fungible tokens (NFTs).
- Explore tokenization and its application in various industries.

TOPICS COVERED:

- Overview of Digital Tokens: Utility vs. Security Tokens
  - Differentiate between utility tokens, which provide access to a product/service, and security tokens, which represent an investment in a company or asset.
- Non-Fungible Tokens (NFTs): Concept, Use Cases, and Marketplace
  - Explore the concept of NFTs and their role in representing unique digital assets like art, collectibles, and intellectual property.
  - Understand the marketplaces where NFTs are bought and sold (e.g., OpenSea, Rarible).
- Token Standards: ERC-20, ERC-721, ERC-1155
  - Learn about token standards on Ethereum, including ERC-20 for fungible tokens, ERC-721 for non-fungible tokens, and ERC-1155 for multi-token types.
- Tokenization of Real-World Assets
  - Explore the tokenization of assets like real estate, art, and commodities, enabling fractional ownership and liquidity of traditionally illiquid assets.

MODULE 4: SMART CONTRACTS AND DECENTRALIZED APPLICATIONS (DAPPS)

LEARNING OUTCOMES:

- Develop and deploy smart contracts on blockchain platforms.
- Understand how decentralized applications (dApps) are built and utilized.
- Examine real-world applications of smart contracts across various industries.

TOPICS COVERED:

- Introduction to Smart Contracts: Definition, Functionality, and Benefits
  - Understand what smart contracts are and how they automate transactions without intermediaries.
  - Explore the benefits of smart contracts, such as transparency, efficiency, and security.
- Solidity Programming and Smart Contract Development
  - Learn Solidity, the programming language used for writing smart contracts on Ethereum.
  - Develop and deploy smart contracts, including hands-on coding exercises and real-world examples.
- Building Decentralized Applications (dApps)
  - Understand how dApps work, from front-end development to interaction with blockchain back-ends.
  - Explore real-world examples of dApps in areas like finance (DeFi), healthcare, and supply chain management.
- Real-World Use Cases: Supply Chain, Finance, Healthcare, Gaming
  - Examine the application of smart contracts and dApps in industries such as supply chain (tracking goods), decentralized finance (lending/borrowing), healthcare (patient data), and gaming (in-game assets).

MODULE 5: DISTRIBUTED LEDGER TECHNOLOGIES (DLTS) BEYOND BLOCKCHAIN

LEARNING OUTCOMES:

- Distinguish between blockchain and other forms of distributed ledger technologies.
- Understand the advantages and challenges of different DLTs.
- Analyze real-world applications of DLT in industries like finance and supply chain.

TOPICS COVERED:

- Distributed Ledgers vs. Blockchain: Key Differences
  - Understand the differences between blockchain and other distributed ledger technologies (DLT), including how data is structured and verified.
- Types of DLT: Hashgraph, DAG, and Holochain
  - Explore alternative DLTs like Hashgraph (gossip protocol), Directed Acyclic Graph (DAG) used by IOTA, and Holochain, which operates without the need for global consensus.
- Use Cases: IOTA, Hyperledger Fabric, and Quorum
  - Study specific use cases of alternative DLTs, including IOTA for IoT devices, Hyperledger Fabric for enterprise applications, and Quorum for private blockchain networks.

- DLT in Supply Chain, Healthcare, and IoT
  - o Analyze the application of DLTs in industries such as supply chain management, healthcare (patient records), and IoT (device-to-device communication).

MODULE 6: GOVERNANCE, REGULATION, AND ETHICAL CONSIDERATIONS

LEARNING OUTCOMES:

- Understand the governance models of decentralized networks.
- Evaluate the regulatory challenges and opportunities surrounding blockchain and cryptocurrencies.
- Discuss the ethical implications of decentralized technologies.

TOPICS COVERED:

- Governance Models: On-Chain vs. Off-Chain Governance
  - o Understand how governance works in decentralized networks, including on-chain governance (where changes are voted on directly on the blockchain) and off-chain governance (external decision-making processes).
- Regulatory Landscape: Global Regulations on Cryptocurrencies and Blockchain
  - o Explore the global regulatory environment for cryptocurrencies, ICOs, and blockchain technology. Discuss legal challenges and how different countries are addressing regulatory issues.
- Compliance Challenges: AML/KYC in DeFi
  - o Learn about Anti-Money Laundering (AML) and Know Your Customer (KYC) compliance requirements in decentralized finance (DeFi) and how blockchain projects address these regulatory needs.
- Ethical Considerations: Privacy, Security, and Decentralization
  - o Discuss the ethical issues surrounding blockchain, such as data privacy, censorship resistance, and the balance between decentralization and governance control.

MODULE 7: CAPSTONE PROJECT

LEARNING OUTCOMES:

- Develop and present a comprehensive solution in blockchain, tokens, and DLT.
- Apply knowledge from the course to solve real-world blockchain problems in a capstone project.
- Understand the future direction of tokens.
- Prepare for professional certifications in blockchain and distributed ledger technology.

TOPICS COVERED:

- Supply Chain Management System Using Blockchain
  - o Design and develop a blockchain-based supply chain management solution. The project could involve tracking the origin, status, and authenticity of goods as they move through the supply chain.
- Tokenization of Real Estate Assets

- Create a platform that enables the tokenization of real estate assets, allowing fractional ownership and liquidity. The project would involve designing a security token that represents ownership in a property, developing smart contracts for property management, and ensuring regulatory compliance.
- Decentralized Voting System
  - Build a decentralized, secure, and transparent voting system using blockchain technology. This system would allow users to cast votes anonymously and ensure that the voting process is immutable and resistant to tampering.
- Blockchain-Based Identity Management System
  - Develop a self-sovereign identity management system where users can store and control their digital identities on the blockchain. The project would involve designing decentralized identity protocols (e.g., using DID standards) and integrating them with real-world applications like KYC in financial services.
- Decentralized Finance (DeFi) Lending Platform
  - Create a decentralized lending platform that allows users to lend and borrow assets without intermediaries. This project would involve deploying smart contracts to handle the loan issuance, interest accrual, and repayment processes, along with tokenizing collateral for security.
- NFT Marketplace for Digital Art
  - Build a decentralized NFT marketplace that enables artists to tokenize their digital artworks as NFTs and sell them directly to buyers. The project could include designing the marketplace, integrating ERC-721/ERC-1155 token standards, and exploring royalty mechanisms for creators.
- Blockchain-Based Health Records System
  - Develop a blockchain solution for storing and sharing patient health records securely. The system would ensure patient privacy through encryption, allow authorized medical professionals to access records, and provide immutable audit trails for medical data.

ATTENDANCE AND EVALUATION

Attendance: 75% of all mandatory classes/mini projects

Evaluation: Score from assignments, mini-projects, online quiz (20 min tests every week), and a final exam.

Evaluation Scheme

Assessment Type	Total Count	Best of	Points / Assessment	Total Points
Quizzes	24	22	5	110
Lab Assignments	24	20	3	60
Mini Projects	24	23	10	230
Final Exams	6	6	100	600
Capstone	1	1	400	400
			Total	1400

Grading Scheme

Letter Grade	Percentage Range
A+	90% - 100%
A	70% - 89%
B+	50% - 69%
B	40% - 49%
C	0% - 40%

Certificate of Completion Criteria:

- Secure more than **40% marks** overall
- Maintain at least **75% attendance** as per the policy

Certificate of Participation Criteria:

- Secure less than **40% marks** overall
- Maintain at least **50% attendance** as per the policy

C Grade: Only participation certificate

Capstone evaluation: Based on the final presentation during the campus visit/online session.