

SCHEME
for
Minor Degree / Specialization



Department of Computer Engineering
FACULTY OF INFORMATICS & COMPUTING

J. C. Bose University of Science & Technology, YMCA
Faridabad, Haryana

J. C. BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA

VISION

J. C. Bose University of Science and Technology, YMCA, Faridabad aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

DEPARTMENT OF COMPUTER ENGINEERING

VISION

The department aims to make a place at both national and international level by producing high quality ethically rich computer engineers conversant with the state-of-the-art technology with the ability to adapt the upcoming technologies to cater to the ever changing industrial demands and societal needs. It endeavours to establish itself as a centre of excellence by contributing to research areas having IT impact on the people's life and nation's growth.

MISSION

- To provide the future leaders in the area of computer engineering and information technology through the development of human intellectual potential to its fullest extent.
- To enable the students to acquire globally competence through problem solving skills and exposure to latest developments in IT related technologies.
- To educate the students about their professional and ethical responsibilities.
- To ensure continuous interaction with the industry and academia through collaborative research projects.

ABOUT THE SCHEME

With a view to enhance the employability skills and impart deep knowledge in emerging areas, usually not being covered in Undergraduate Degree framework, concept of 'Minor Degree / Specialization' in emerging areas is being introduced from academic session 2022-

23. Proposed Minor Degree / Specialization will require the earning of 18 to 20 credits. This scheme shall be an addition to the regular undergraduate program implying that its passing/failure shall not affect the result of regular undergraduate program being pursued by the student. Upon successful completion of the course, Minor / Specialization Degree shall be awarded to the candidate.

The Computer Engineering Department of the University has introduced the curriculum for following Minor / Specialization:

1. Computer Vision
2. Blockchain

These emerging areas will help students in capturing the plethora of employment opportunities available in these domains.

NOTE

1. The scheme will be applicable from Academic Session 2022-23 onwards.
2. This will be a three-semester program which will start in the 5th sem of the B.Tech. program.

Blockchain

Minor Degree in “Blockchain”

SNO	Code No.	Course Title	Hours per week			Credits	Semester	Marks for Sessional	Marks for End Term Examination	Total
			L	T	P					
1	MD-BLC-501	Fundamentals of Blockchain	3	0	0	3	5	25	75	100
2	MD-BLC-502	Blockchain Platforms Smart Contracts and Use cases	4	0	0	4	6	25	75	100
3	MD-BLC-503	Solidity Lab	0	0	2	2	6	15	35	50
4	MD-BLC-504	Minor Project	0	0	2	2	6	25	25	50
5	MD-BLC-505	Blockchain Security and Next Generation Applications	4	0	0	4	7	25	75	100
6	MD-BLC-506	Major Project	0	0	4	4	7	50	50	100



CODE: MD-BLC-501

SUBJECT NAME: Fundamentals of Blockchain

CREDITS: 3

B.TECH. 5th SEMESTER

SESSIONAL: 25

L TP

THEORY EXAM: 75

3 0 0

TOTAL: 100

Course Objectives:

The students will be able to

1. To understand a broad overview of the essential concepts of blockchain technology.
2. To familiarize students with Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming.
3. to learn about different types of blockchain and consensus algorithms.

Module 1

Basics: The Double-Spend Problem, Byzantine Generals' Computing Problems, Public-Key Cryptography, Hashing, Distributed Systems, Distributed Consensus.

Module 2

Technology Stack: Blockchain, Protocol, Currency.

Bitcoin Blockchain: Structure, Operations, Features, Consensus Model, Incentive Model.

Module 3

Ethereum Blockchain: Smart Contracts, Ethereum Structure, Operations, Consensus Model, Incentive Model.

Smart contracts and solidity programming: Contracts, state and local variables, getter and setter function, constructor, static and dynamic array, byte array, pure and view functions, structure, loops

Module 4

Tiers of Blockchain Technology: Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Side chains.

Module 5

Types of Consensus Algorithms: Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposit-Based Consensus.



Course Outcomes

After completion of this course, students would be able:

1. To explain the basic notion of distributed systems.
2. To use the working of an immutable distributed ledger and trust model that defines blockchain.
3. To illustrate the essential components of a blockchain platform.

References:

1. Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing.
2. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
3. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (2017).
4. Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher O'Reilly Publisher Media; 1st edition (2015).
5. Mastering Bitcoin: Programming the Open Blockchain by Andreas Antonopoulos.

Corresponding Online Resources:

1. <https://www.coursera.org/specializations/blockchain>.
2. <https://nptel.ac.in/courses/106105184/>
3. Introduction to Blockchain Technology and Applications, https://swayam.gov.in/nd1_noc20_cs01/preview



CODE: MD-BLC-502

SUBJECT NAME: Blockchain Platforms, Smart Contracts and Use cases

CREDITS: 4

B.TECH. 6th SEMESTER

SESSIONAL: 25

L TP

THEORY EXAM: 75

40 0

TOTAL: 100

Course Objective:

1. Students should be able to understand the concept of smart contracts related to blockchain.
2. Students should be able to understand the smart contract higher-level language Solidity and apply it to create smart contracts.
3. Students should be able to learn Truffle IDE for creating and deploying a DApp.
4. Students should be able to understand several types of blockchain use cases.

Module 1

Smart Contracts: Definition and Need, Features of Smart Contracts, Life Cycle of a Smart Contract, Introduction to Ethereum Higher-Level Languages.

Module 2

Development Environment: Building A Simple Smart Contract with Solidity, Solc-Compiler, Ethereum Contract ABI, Remix-IDE for Smart Contract Development.

Module 3

Truffle Framework & Ganache: Environment Setup for Truffle & Ganache, Truffle Project Creation, Truffle Compile, Migrate and Create Commands.

Module 4

Decentralized App Creation: Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End Application, Deploying Dapp, Validation, And Testing of Dapp.

Module 5

Blockchain Use Cases: Financial Services Related Use Cases, Revolutionization of Global Trade, Digital Identity, Auditing Services, Supply Chain Management, Healthcare Related Services, Blockchain and IOT, Blockchain and AI.



Text Books/References:

1. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
2. Building Blockchain Projects, Narayan Prusty, Packt Publishing.
3. Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas Antonopoulos and Gavin Wood, Shroff Publisher/O'Reilly Publisher.
4. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
5. Building Blockchain Projects, Narayan Prusty, Packt Publishing.
6. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (March 17, 2017).
7. Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher publisher/O'Reilly Publisher Media; 1st edition (2015).

Corresponding Online Resources:

1. <https://www.coursera.org/learn/smarter-contracts>
2. <https://www.udemy.com/course/solidity-smart-contracts-build-dapps-in-ethereum-blockchain/>
3. Introduction to Blockchain Technology and Applications, https://swayam.gov.in/nd1_noc20_cs01/preview
4. <https://nptel.ac.in/courses/106105184/>
5. <https://www.coursera.org/learn/blockchain-platforms>.
6. Introduction to Blockchain Technology and Applications, https://swayam.gov.in/nd1_noc20_cs01/preview.

Course Outcomes: After completion of course, students would be able to:

1. To understand the working and importance of smart contracts.
2. To learn the solidity language required for coding Ethereum smart contracts.
3. To create and deploy a DApp on a Ethereum test network.
4. To understand different types of uses of blockchain and apply it to some real-life scenarios accordingly.



CODE: MD-BLC-503

SUBJECT NAME: Solidity Lab

CREDITS: 2

B.TECH. 6th SEMESTER

L TP

002

SESSIONAL: 15

THEORY EXAM: 35

TOTAL: 50

SOLIDITY LAB

Introduction to Solidity: Contracts, Constructors & Functions, Variables, Getters & Setters, Arrays, Memory vs Storage, Mappings in Solidity

Advanced Solidity: Structs, Error Handling & Restrictions, Libraries, Global Variables in Solidity, Abstract Contracts, Inheritance, And Interfaces, Events

CODE: MD-BLC-504

SUBJECT NAME: Minor Project

CREDITS: 2

B.TECH. 6th SEMESTER

L TP

002

SESSIONAL: 25

THEORY EXAM: 25

TOTAL: 50

Minor project to implement smart contracts in Solidity.



CODE: MD-BLC-505

**SUBJECT NAME: Blockchain Security and Next
Generation Applications**

CREDITS: 4

B.TECH. 7th SEMESTER

SESSIONAL: 25

L TP

THEORY EXAM: 75

40 0

TOTAL: 100

Course Objective:

1. Students should be able to understand the security and performance-related issues of blockchain.
2. Students should be able to learn techniques and tools to tackle the security related issues of blockchain.
3. Students should be able to understand the benefits of using blockchain in financial sector.
4. Students should understand how decentralized nature of blockchain is impacting banking and financial sector.

Module 1

Security Issues: Blockchain Related Issues, Higher-Level Language (Solidity) Related Issues, EVM Bytecode Related Issues, Real-Life Attacks on Blockchain Applications/ Smart Contracts, Trusted Execution Environments.

Module 2

Security Tools for Smart Contracts: Working, Advantages, And Disadvantages of Tools- Oyente, Securify, Maian, Manticore, Mythril, SmartCheck, Verx. Secure Key Management, Quantum Resilience Keys.

Module 3

Performance Related Issues: Transaction Speed, Transaction Fees, Network Size, Complexity, Interoperability Problems, Lack of Standardization. Lack of Supportive Regulations Related to Blockchain Applications.

Module 4

Cryptocurrencies: Concept, Cryptocurrency Mining, Uses of Cryptocurrencies, Tokens, Token vs Crypto Coin, Concept of ICOs (Initial Coin Offerings), Benefits of Using ICOs, STOs (Security token offerings), ICO vs STO, Cryptocurrency wallets.



Module 5

Decentralized Finance (DeFi): Concept, Benefits and Risks Associated with DeFi, Centralized vs Decentralized finance, DeFi Projects, DeFi future trends.

Module 6

Decentralized Markets: Concept of Decentralized markets, impact of decentralization on financial market, Decentralized Exchanges (DEX), Security, control and privacy concerns related to DEX, Liquidity and Usability of DEX, best DEXs for trading,

Text Books/References:

1. Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas Antonopoulos and Gavin Wood, Shroff Publisher/O'Reilly Publisher.
2. Melanie Swan, Blockchain: Blueprint for a new economy, Shroff Publisher/O'Reilly Publisher.
3. Ron Quaranta, Blockchain in Financial Markets and Beyond: Challenges and Applications, Risk Books Publisher.
4. Richard Hayen, Blockchain & FinTech: A Comprehensive Blueprint to Understanding Blockchain & Financial Technology. - Bitcoin, FinTech, Smart Contracts, Cryptocurrency, Risk Books Publisher.

Corresponding Online Resources:

1. <https://www.edx.org/course/blockchain-and-fintech-basics-applications-and-limitations>
2. <https://www.accenture.com/in-en/insight-blockchain-technology-how-banks-building-real-time>
3. <https://medium.com/search?q=decentralized%20exchange>
4. Emerging Technology Projection: The Total Economic Impact™ Of IBM Blockchain <https://www.ibm.com/downloads/cas/QJ4XA0MD>
5. <https://www.globallegalinsights.com/practice-areas/blockchain-laws-and-regulations/india#chaptercontent1>
6. <https://www.eduonix.com/blockchain-and-cryptocurrencies-for-beginners>
7. <https://www.coursera.org/learn/cryptocurrency>

Course Outcomes: After completion of course, students would be able to:

- To understand the security and performance perspective of blockchain technology.
- To learn and apply security analysis and performance-enhancing techniques related to blockchain.
- To understand difference between different types of coins and tokens related to blockchain technology.
- To understand the benefits of blockchain in banking sector.



B.TECH. 7th SEMESTER

CODE: MD-BLC-506

SUBJECT NAME: Major Project

CREDITS: 4

L	T	P
0	0	4

SESSIONAL: 50

THEORY EXAM: 50

TOTAL: 100

Major project to implement Blockchain Technology.