Course Syllabus
Gyanmanjari Institute of Technology
Semester-7 (B.Tech.)

Subject: Blockchain Technology - BETCE17408

Type of course: Professional Core

Prerequisite: Basic knowledge of Computer Programming, Data Structures, Database Management Systems, and Cryptography.

Rationale:

Blockchain Technology enables secure, transparent, and decentralized management of digital transactions and records without a central authority. It integrates cryptography, consensus mechanisms, and smart contracts to build trusted applications across various domains. This course provides fundamental and practical knowledge of blockchain technologies, enterprise platforms, and decentralized applications, preparing students for industry and research in emerging digital ecosystems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No	Course content	Hrs.	% Weightage
1	**Introduction to Blockchain and Distributed Systems** Evolution of Blockchain (1.0 to 5.0), Distributed Ledger Technology, Blockchain Architecture, Blocks and Transactions, Merkle Tree, Blockchain Components, Public, Private, Consortium and Hybrid Blockchain, Applications of Blockchain, Blockchain Challenges.	12	20%
2	**Blockchain Cryptography and Consensus** Cryptography, Hash Functions, SHA-256, Digital Signatures, ECC, Public and Private Keys, Wallets and Addresses, Consensus Mechanisms, PoW, PoS, DPoS, PBFT, Proof of Authority, Raft Consensus, Tendermint, Security Threats, Double Spending, 51% Attack, Sybil Attack, Eclipse Attack.	12	20%
3	**Bitcoin and Ethereum** Bitcoin Architecture, UTXO Model, Mining Process, Bitcoin Transactions, Ethereum Architecture, Ethereum Accounts, Gas Mechanism, Ethereum Virtual Machine, ERC-20 Tokens, ERC-721 NFTs, Web3 Fundamentals.	12	20%
4	**Smart Contracts and DApp Development** Smart Contract Concepts, Solidity Programming, Data Types and Functions, Events and Modifiers, Remix IDE, Ganache, MetaMask, Hardhat, DApp Architecture, Web3.js and Ethers.js.	12	20%
5	**Enterprise Blockchain and Emerging Trends** Hyperledger Fabric Architecture, Chaincode, Channels and Peers, Corda, Ripple, Blockchain Interoperability,IPFS, DeFi, DAO, Blockchain Security, Blockchain Scalability, Research Trends and Future Scope.	12	20%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Blockchain Explorer Analysis:** Each Students will analyze live Bitcoin and Ethereum transactions using blockchain explorers (Etherscan/Blockchain.com). They will identify transaction hash, block number, gas fee, wallet address, confirmations, and prepare a short report explaining transaction validation and blockchain transparency. The report and screenshots shall be uploaded on the GMIU portal.	10
2	**Smart Contract Development and Deployment:** Each Students will develop a basic Solidity smart contract (Student Record, Voting System, or Bank Account) using Remix IDE and deploy it on a local Ethereum network (Ganache). Students shall demonstrate execution and submit source code, deployment screenshots, and output on the GMIU portal.	10
3	**Blockchain Case Study and Technology Review:** Each Students will study a real-world blockchain application (Supply Chain, Healthcare, Banking, Education, NFT Marketplace, DeFi, or Land Registry), analyze its architecture and advantages, and prepare a technical report highlighting blockchain implementation challenges and future scope. The report shall be submitted through the GMIU portal.	10
	Total	30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	**Remembrance (R)**	**Understanding (U)**	**Application (A)**	**Analyze (N)**	**Evaluate (E)**	**Create (C)**
Weightage %	20%	30%	15%	15%	10%	10%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand blockchain fundamentals, architecture, and blockchain models.
CO2	Apply cryptography and consensus mechanisms in blockchain systems.
CO3	Analyze Bitcoin, Ethereum, and blockchain transactions.
CO4	Develop smart contracts and decentralized applications (DApps).
CO5	Evaluate enterprise blockchain platforms and emerging blockchain technologies.

List of Practical:

Sr. No	Description	Unit No	Hrs.
1	Study the architecture and components of Blockchain Technology.	01	02
2	Study different types of blockchain and distributed ledger concepts.	01	02
3	Implement SHA-256 hashing for message integrity verification.	02	02
4	Implement public-key cryptography and digital signature generation and verification.	02	02
5	Demonstrate the working of blockchain consensus mechanisms through simulation.	02	02
6	Analyze Bitcoin transactions, block structure, and mining process.	03	02
7	Analyze Ethereum accounts, transactions, and gas mechanisms.	03	02
8	Study and perform digital currency transactions using blockchain wallets.	03	02
9	Develop a simple smart contract for storing and retrieving data.	04	02
10	Develop a blockchain-based student record management smart contract.	04	02
11	Develop a blockchain-based voting smart contract.	04	02
12	Develop a simple ERC-20 token smart contract.	04	02
13	Develop a simple decentralized application (DApp) integrated with blockchain transactions.	04	02
14	Study enterprise blockchain platforms and blockchain interoperability concepts.	05	02
15	Study decentralized storage systems and their integration with blockchain applications.	05	02
		Total	30

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] Shahid Shaikh and Elad Elrom, Building Decentralized Blockchain Applications, BPB Publications, 2021.
[2] Imran Bashir, Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained, Packt Publishing, 4th Edition, 2023.
[3] Nakomoto, Satoshi, Bitcoin: A peer - to - peer electronic cash system, Research paper
[4] Elad Elrom, The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing, and Securing Distributed Blockchain-based Projects, Apress, 2019.
[5] Roger Wattenhofer, The Science of the Blockchain, CreateSpace Independent Publishing Platform, 2016.