BLOCKCHAIN TECHNOLOGIES

Course code: 20CS1160

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Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the basics and various types of block chain technology **(L2)**
CO2: Explain the cryptographic primitives, basics and structure of bitcoin. **(L2)**
CO3: Build an application using Ethereum development tools **(L3)**
CO4: Explain different protocols based on Ethereum stack.**(L2)**
CO5: Understand the basics of Hyper ledger Fabric. **(L2)**

UNIT-I (10 Lectures)

INTRODUCTION:

Introduction: Distributed systems, The history of blockchain, Introduction to blockchain, Various technical definitions of blockchain, Generic elements of a blockchain, Features of a blockchain, Applications of blockchain technology, Tiers of blockchain technology.

Types and Consensus in blockchain: Types of blockchain,Consensus in Blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain. **(Text book -1)**

Learning Outcomes: At the end of the module, students will be able to:

1. Understand the basics of blockchain and its applications (L2)
2. Describe various types of blockchain. (L2)
3. Illustrate the consensus in Blockchain. (L2)

UNIT-II (10 Lectures)

UNDERSTANDING BLOCKCHAIN WITH CRYPTOCURRENCY:

Cryptographic Primitives: Merkle Tree, Patricia Tree, Digital Signatures, Elliptic Curve Digital signature algorithm (ECDSA).

Bitcoin : Bitcoin**,** Bitcoin definition,, The transaction life cycle, The transaction structure, Types of transaction .UTXO.
Structure of Bitcoin : The structure of a block, The structure of a block header, The genesis block.
(Text book -1)

Learning Outcomes: At the end of the module, students will be able to:

1. Understand the Merkel tree data structure..(L2)
2. Understand the basics of Bitcoin.(L2)
3. Understand the structure of Bitcoin.. (L2)

UNIT-III (12 Lectures)

INTRODUCTION TO ETHEREUM:

Introduction: Introduction, Ethereum blockchain , Elements of the Ethereum blockchain, Ethereum virtual machine (EVM) .

Setting up Ethereum Development Tools: Ethereum Development - Setting up a development environment .

Smart Contract : History ,Definition ,Ricardian contracts. **(Text book -1)**

Learning Outcomes: At the end of the module, students will be able to:

1. Understand the functionalities of Ethereum blockchain(L2)
2. Explain the working of Ethereum virtual machine.(L2)
3. Deploying a smart contract using Ethereum.(L3)

UNIT-IV (8 Lectures)

BLOCKCHAIN HYPERLEDGER FABRIC:

Hyperledger: HyperLedger Projects. Hyperledger as a protocol.

HyperledgerFabric:HyperledgerFabric, Fabric architecture, Components of the Fabric.
(Text book -1)

NFT and DLT: Non-Fungible Tokens ,Four Types of NFTs ,DLT: The Beating Heart of Blockchain.
(Text book -3)

Learning Outcomes: At the end of the module, students will be able to:

1. Illustrate the projects based on Hyperledger(L2)
2. Understand the Architecture of Hyperledger fabric.(L2)
3. Understand the Components of Hyperledger fabric. (L2)

UNIT-V (10 Lectures)

COMMUNICATION, STORAGE PROTOCOLS AND BLOCKCHAIN ENTERPRISE APPLICATIONS:

Blockchain Applications: From Web 2.0 to the Next Generation Decentralised Web,Domain specific Blockchain Applications,Blockchain Application Components ,Design methodology for Blockchain Applications,Blockchain Application Templates.

Whisper and Swarm: Whisper Communication Protocol,Swarm Architecture and Concepts
(Text book -2)

Learning Outcomes: At the end of the module, students will be able to:

1. Illustrate the applications of blockchain (L2)
2. Understand the Decentralised Messaging Platform - Whisper (L2)
3. Understand the Decentralised Storage Platform - Swarm.(L2)

Text Books:

1. Imran Bashir, “Mastering Blockchain”, Packt publishers, 2017.
2. Arshdeep Bahga and Vijay Madisetti, “Blockchain Applications: A Hands-On Approach”. 1st Edition, 2018
3. NFTs, the Metaverse, and Everything Web 3.0 by Evan Karnoupakis

Reference Books:

1. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O′Reilly
2. Matt Zand, Xun (Brian) Wu, and Mark Anthon, “Hands-on Smart Contract Development with Hyperledger Fabric V2: Building Enterprise Blockchain Applications”, O′Reilly.

NPTEL/ Youtube/ Faculty Video/ Textbook Link:

1. DLT Labs channel: https://www.youtube.com/channel/UCrDO3c1gITXt2QjA7SUMwtA
2. DLT Labs Blogs: https://www.dltlabs.com/blog
3. Hyperledger Channel: https://www.youtube.com/channel/UC7_X0WkMtkWzaVUKF-PRBNQ
4. Ethereum Channel: https://www.youtube.com/channel/UCNOfzGXD_C9YMYmnefmPH0g
5. NPTEL: https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/
6. Solidity doc: https://docs.soliditylang.org/en/v0.8.13/#