Savitribai Phule Pune University
T.Y.B.Sc. (Computer Science) - Sem – V
Course Type: SECC – II Course Code : CS-3511
Course Title: Blockchain Technology

Teaching Scheme	No. of Credits	Examination Scheme:
03 Lect / week	2	IE : 15 marks UE: 35 marks

Prerequisite:
Understanding of Object Oriented Programming Concepts
Knowledge of Python

Course Objectives

1. Understand what and why of blockchain technology.
2. Explore major components of blockchain.
3. Learn about Bitcoin, Cryptocurrency and Ethereum.
4. To learn blockchain programming using Python, Flask Web Framework, and HTTP client Postman.

Course Outcomes

On completion of the course, student will be able to–

1. Learn the fundamentals of Blockchain Technology.
2. Learn Blockchain programming
3. Basic knowledge of Smart Contracts and how they function.

Course Contents

Chapter 1	**Introduction to Blockchain**	**7 Lect**

- Foundational Computing Concepts (Client-Server systems vs Peer to Peer Systems)
- Evolution of Blockchain
- Blockchain Vs Database
- Essentials of Blockchain (Blockchain generations, types of blockchain, benefits and challenges of blockchain usage)
- Types of Networks
- Layered Architecture of Blockchain Ecosystem
- Components of blockchain
- Cryptography (private and public keys, Hashing &
- Digital Signature)
- Consensus Mechanisms
- Cryptocurrency, Digital Currency Bitcoin and Ethereum
- Smart Contracts
- Blockchain use cases

Chapter 2	**How Blockchain Works?**	**5 Lect**

- Understanding SHA256 Hash
- Immutable Ledger
- Distributed P2P Network
- How Mining Works? (The NONCE and Cryptographic Puzzle)
- Byzantine Fault Tolerance
- Consensus Protocols: Proof of Work, Proof of State, Défense Against Attackers, Competing Chains
- Blockchain Demo

Chapter 3	Smart Contracts	6 Lect

- Ethereum Network
- What is a Smart Contract?
- Ethereum Virtual Machine, Ether, Gas
- DApps
- Decentralized Autonomous Organizations (DAO)
- Hard and Soft Forks
- Initial Coin Offerings
- Demo of Smart Contracts

Demonstration	Programming Assignments:	18 Lect

Out of 36 lectures, 18 are assigned for demonstration. Teacher should give demonstration of various programs mentioned below in the classroom or in the laboratory as per their convenience.

Assignment 1 –Demonstration of Blockchain
https://andersbrownworth.com/blockchain

Assignment 2 – Installation of Ganache, Flask and Postman

Assignment 3 –Write a Simple Python program to create a Block class that contains index, timestamp, and previous hash. Connect the blocks to create a Blockchain.

Assignment 4 –Demo of Remix-Ethereum IDE https://remix.ethereum.org and Test Networks

Assignment5–1. Write a Simple Smart Contract for Bank with withdraw and deposit functionality.

Assignment 6 – 2. Write a Smart Contract for storing and retrieving information of Degree Certificates.

Reference Books:

Textbook:

1. **Beginning Blockchain : A Beginner's Guide to Building Blockchain Solutions By Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress Media**

Reference Books:

2. Mastering Blockchain by Imran Bashir, Third Edition, Packt Publication
3. Waterhole, The Science of the Blockchain
4. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
5. Mastering Ethereum: Building Smart Contracts and DAPPS, by Andreas Antonopoulos, Dr. Gavid Wood, Oreilly Publication

Reference Web Links

1. https://www.investopedia.com/terms/b/blockchain.asp