## SEMESTER S7

### BLOCKCHAIN TECHNOLOGY

| Course Code | PEITT743 | CIE Marks | 40 |
|---|---|---|---|
| Teaching Hours/Week (L: T:P: R) | 3:0:0:0 | ESE Marks | 60 |
| Credits | 3 | Exam Hours | 2 Hrs. 30 Min. |
| Prerequisites (if any) | PCITT601: Cryptography and Network Security | Course Type | Theory |

**Course Objectives:**

1. Students will be familiar with the working of popular blockchain platforms: bitcoin & Ethereum and will acquire understanding of underlying principles of blockchain.
2. Students will be able to develop and deploy smart contracts in Ethereum blockchain.

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**SYLLABUS**

| Module No. | Syllabus Description | Contact Hours |
|---|---|---|
| 1 | **Blockchain Introduction:** *Fundamentals of blockchain* - historical background, basic terminologies in Blockchain, structure of a block *(till this from Ref. 3)*, Blockchain architecture, generic elements of a blockchain, How blockchain works, benefits, features, and limitations of blockchain *(till this from Textbook 1)*, Types of Blockchain, The Evolutionary Transformation of Blockchain, Comparison of different generation of blockchain *(till this from Ref. 3)*<br>**Decentralization using blockchain:** Methods of decentralization, Routes to decentralization, Blockchain and full ecosystem decentralization, IPFS basics | 8 |
| 2 | **Cryptography for blockchain:** cryptographic primitives - Secure Hash algorithms, Applications of cryptographic hash functions, Message Authentication Codes, Digital signatures, Merkle tree, Elliptic curve cryptography fundamentals | 9 |

| | | |
|---|---|---|
| | **Consensus Algorithms:** Introducing the consensus problem, The Byzantine generals problem, Fault tolerance, FLP impossibility, Classification and categories of consensus algorithms - CFT algorithms, BFT algorithms, Nakamoto consensus, Proof of Stake, Choosing a consensus algorithm | |
| **3** | **Bitcoin:** The beginnings of Bitcoin, Bitcoin Definition, Bitcoin - a user's perspective, Cryptographic keys, Addresses in Bitcoin, Transactions, The transaction lifecycle, The transaction data structure, The Script language, Types of scripts, Coinbase transactions, Transaction validation, Transaction bugs, Bitcoin blockchain, The genesis block, Mining, Proof of work, The mining algorithm, The hash rate, Mining systems, Mining pools, wallets | **7** |
| **4** | **Ethereum:** A General-Purpose Blockchain, Ethereum's components, Ethereum and Turing Completeness, From General-Purpose Blockchains to Decentralized Applications (DApps), Ether currency units, Getting Started with MetaMask, Introducing the world Computer, Externally Owned Accounts (EOAs) and Contracts<br>**A simple Contract:** A Test Ether Faucet, Compiling the Faucet Contract, Creating the Contract on the Blockchain, Interacting with the Contract, The Structure of a Transaction, Special Transaction: Contract Creation, A Blockchain Based Supply Chain Management Testcase ( from Ref. 3)<br>**Smart Contracts and Solidity:** Life Cycle of a Smart Contract, Building a Smart Contract with Solidity, The Ethereum Contract ABI, Programming with Solidity<br>**Tokens:** How Tokens Are Used, The ERC20 Token Standard, Launching Our Own ERC20 Token, | **12** |

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**Course Assessment Method**

**(CIE: 40 marks, ESE: 60 marks)**

**Continuous Internal Evaluation Marks (CIE):**

| Attendance | Assignment/ Microproject | Internal Examination-1 (Written) | Internal Examination- 2 (Written) | Total |
|---|---|---|---|---|
| **5** | **15** | **10** | **10** | **40** |

**End Semester Examination Marks (ESE):**

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

| Part A | Part B | Total |
|---|---|---|
| • 2 Questions from each module.<br>• Total of 8 Questions, each carrying 3 marks<br><br>**(8x3 =24marks)** | • Each question carries 9 marks.<br>• Two questions will be given from each module, out of which 1 question should be answered.<br>• Each question can have a maximum of 3 sub divisions.<br>**(4x9 = 36 marks)** | **60** |

**Course Outcomes (COs)**

At the end of the course students should be able to:

| | Course Outcome | Bloom's Knowledge Level (KL) |
|---|---|---|
| **CO1** | summarize foundational concepts of decentralization with blockchain | **K2** |
| **CO2** | Interpret the importance of cryptography and consensus in Blockchain | **K2** |
| **CO3** | Outline the working of Bitcoin blockchain | **K2** |
| **CO4** | Build and deploy smart contract in Ethereum blockchain | **K3** |

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

**CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | 3 | - | - | - | - | - | - | - | 3 |
| **CO2** | 3 | - | - | 3 | 2 | - | - | - | - | - | - | 3 |
| **CO3** | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 3 |

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

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| Text Books | | | | |
|---|---|---|---|---|
| **Sl. No** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
| 1 | Mastering Blockchain | Imran Bashir | Packt Publishing Ltd. | 3rd Edition 2020 |
| 2 | Mastering Ethereum | Andreas M. Antonopoulos and Dr. Gavin Wood | O'Reilly Media, Inc | 1st Edition 2018 |

| Reference Books | | | | |
|---|---|---|---|---|
| **Sl. No** | **Title of the Book** | **Name of the Author/s** | **Name of the Publisher** | **Edition and Year** |
| 1 | Mastering Blockchain | Lorne Lantz and Daniel Cawrey | O'Reilly Media, Inc., | 1st Edition 2020 |
| 2 | Solidity Programming Essentials | Ritesh Modi | Packt Publishing | 1st Edition 2018 |
| 3 | Blockchain 1.0 to Blockchain 4.0—The Evolutionary Transformation of Blockchain Technology | Pratyusa Mukherjee, Chittaranjan Pradhan | De Gruyter | May, 2021 |
| 4 | Bitcoin: A Peer-to-Peer Electronic Cash System | Satoshi Nakamoto | Bitcoin.org | Oct, 2008 |

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| Video Links (NPTEL, SWAYAM…) | |
|---|---|
| **No.** | **Link ID** |
| **1** | https://nptel.ac.in/courses/106105235 |
| **2** | https://nptel.ac.in/courses/106105235 |
| **3** | https://nptel.ac.in/courses/106105235 |
| **4** | https://onlinecourses.swayam2.ac.in/aic21_ge01/preview |