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| C:\Users\TEMP.WDC.013\Downloads\VIT logo.png  **Version 06/24-7** | **Consolidated Academic Administration Plan for the Course**  ***Blockchain (Elective) Sem. VII – Program Computer Engineering***  ***2024-2025 –Odd Semester***  ***Faculty -Dr. Dilip Motwani (Cluster Mentor) & Prof. Swapnil Sonawane*** |

**The academic resources available in VIT –**

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| **VMIS (ERP)** | **V-Refer and V-Live** | **VIT Library** | **VAC & MOOC Courses** |
| Institute & Department Vision and Mission | Former IA question papers and solutions (prepared by faculty) | Former IA question papers solutions - hardcopy | Value Added Courses (VAC) are conducted throughout the semester & in the semester break - Enrol for the VACs |
| Program Educational Objectives (PEO) | MU end semester examination question papers and solutions (prepared by faculty) | MU end semester exam question paper & solutions - by faculty, hardcopy |
| Program Specific Outcome (PSO) | Class notes and Digital Content for the subject (scanned / typed by faculty) | All text books, reference books, e -books mentioned in the syllabus & AAP | Online courses from NPTEL, Coursera etc. are pursued throughout the semester - Register for the course & get certified |
| Program Outcome (PO) | Comprehensive question bank, EQ, GQ, PPT, Class Test papers | Technical journals and magazines for reference |
| Departmental Knowledge Map | Academic Administration Plan & Beyond Syllabus Activity report | VIT library is member of IIT Bombay Library | Watch former lectures captured in LMS at VIT |

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| **1.a** | **Course Objectives (Write in detail – as per NBA guidelines)** |

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| Cognitive | What do you want students to know? | What is blockchain, Components of blockchain and different Consensus algorithms |
| Affective | What do you want students to think / care about? | Types of Smart Contracts, different approaches of smart contract, Use of public or private blockchain to solve problems |
| Behavioural | What do you want students to be able to do? | Design Smart Contract using Solidity. Design blockchain application for different case studies like Voting system or Supply chain management |

**Advice to Students:**

Attend every class!!! Missing even one class can have a substantial effect on your ability to understand the course. Be prepared to think and concentrate, in the class and outside. I will try to make the class very interactive. Participate in the class discussions. Ask questions when you don’t understand something. Keep up with the class readings. Start assignments and homework early. Meet me in office hour to discuss ideas, solutions or to check if what you understand is correct. The v-Refer Link for this course:

**Collaboration Policy:**

We encourage discussion between students regarding the course material. However, no discussion of any sort is allowed with anyone on the assignment and homework for the class. If you find solution to some problems in a book or on the internet, you may use their idea for the solution; provided you acknowledge the source (name and page in the book or the website, if the idea is found on the internet). Even though you are allowed to use ideas from another source, you must write the solution in your own words. If you are unsure whether or not certain kinds of collaboration is possible please ask the teacher.

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| **1.b** | **Course Outcome (CO) Statements and Module-Wise Mapping (follow NBA guideline)** |

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| CO No. | Statements | Related Module/s |
| CO1 | Explain blockchain concepts. | 1 |
| CO2 | Apply cryptographic hash required for blockchain. | 2 |
| CO3 | Apply the concepts of smart contracts for an application. | 3 |
| CO4 | Design a public blockchain using Ethereum | 4 |
| CO5 | Design a private blockchain using Hyperledger. | 5 |
| CO6 | Use different types of tools for blockchain applications | 6 |

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| **1.c** | **Mapping of COs with POs (mark S: Strong, M: Moderate, W: Weak, Dash ‘–’: not mapped)**  **(List of POs is available in V-refer)** |

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|  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 |
| CO1 | S | W | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO2 | S | -- | M | -- | W | -- | -- | -- | -- | -- | -- | -- |
| CO3 | -- | S | M | M | -- | -- | -- | -- | -- | -- | -- | -- |
| CO4 | -- | S | M | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO5 | -- | S | M | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| CO6 | -- | -- | S | M | -- | -- | -- | -- | -- | -- | -- | -- |

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| **1.d** | **Mapping of COs with PSOs (mark S: Strong, M: Moderate, W: Weak, Dash ‘–’:not mapped)** |

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|  | PSO 1 | PSO 2 | PSO 3 |
| CO1 | M | -- | -- |
| CO2 | M | -- | -- |
| CO3 | S | -- | -- |
| CO4 | S | -- | -- |
| CO5 | S | -- | -- |
| CO6 | M | -- | -- |

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| **1.e** | **Teaching and Examination Scheme (As specified by the University) for the Course** |

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| Categories | Humanities and Social Sciences | Basic Science | Engineering Science | Professional Core | General Education | Professional Elective | Project/ Internship | Open Elective |
| Tick suitable category | **--** | **--** | **--** | **--** | **--** | √ | **--** | **--** |

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| Subject Code | Subject Name | **Teaching Scheme** | | | Credits Assigned | | | |
| Theory | Practical | Tutorial | Theory | TW/Practical | Tutorial | Total |
| CSDC7022 | Blockchain | 3 | -- | -- | 3 | -- | -- | 3 |
| CSDL7022 | Blockchain Lab | -- | 2 | -- | -- | 1 | -- | 1 |

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| Subject Code | Subject Name | **Examination Scheme** | | | | | |
| Theory Marks MSE Test | End Sem. Exam Marks | ISA  TH | ISA Lab | Oral | Total |
| CSDC7022 | Blockchain | 30 | 50 | 20 | -- | -- | 100 |
| CSDL7022 | Blockchain Lab | -- | -- | -- | 25 | -- | 25 |

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| **1.f** | **Faculty-Wise Distribution of all Lecture-Practical-Tutorial Hours for the Course** |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Divisions | Lecture (Hrs.) | Practical (Hrs.) | | | | Tutorial (Hrs.) | | | |
| Batch 1 | Batch 2 | Batch 3 | Batch 4 | Batch 1 | Batch 2 | Batch 3 | Batch 4 |
| A | 03  SSO | 02  SSO | 02  SSO | 02  SSO | 02  SSO | -- | -- | -- | -- |
| B | 03  SSO | 02  SSO | 02  SSO | 02  SSO | -- | -- | -- | -- | -- |

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| **1.g** | **Office Hours (Faculty will be available in office in this duration for solving students’ query)** |

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| Division | Day | Time (at least 1 Hr. / Division) | Venue (Office Room No.) |
| A | Friday | 03:45 PM to 04:45 PM | M-209 |
| B | Friday | 03:45 PM to 04:45 PM | M-209 |

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| **2.a** | **Syllabus : Module Wise Teaching Hours and % Weightage in University Question Paper** |

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| --- | --- | --- | --- |
| Module No. | Module Title and Brief Details | Teaching Hrs. for each module | % Weightage in University Question Papers |
| 1 | **Introduction**  What is a blockchain, Origin of blockchain (cryptographically secure hash functions), Foundation of blockchain: Merkle trees  Components of blockchain, Block in blockchain, Types: Public, Private, and Consortium, Consensus Protocol, Limitations and Challenges of blockchain | 6 | 15% |
| Learning Outcome | 1. Identify the fundamental concepts and components of blockchain technology.*(Knowledge)* 2. Explain the origin and development of blockchain and its key components. *(Comprehension)* 3. Differentiate between Public, Private, and Consortium blockchains. *(Application)* 4. Describe various consensus protocols and their importance. *(Analysis)* 5. Identify the limitations and challenges of blockchain technology. *(Evaluation)* 6. Analyze real-world applications of blockchain in various industries. *(Synthesis)* | | |
| 2 | **Cryptocurrency**  Bitcoin, Altcoin, and Tokens (Utility and Security), Cryptocurrency wallets: Hot and cold wallets, Cryptocurrency usage, Transactions in Blockchain, UTXO and double spending problem  Bitcoin blockchain: Consensus in Bitcoin, Proof-of-Work (PoW), Proof-of-Burn (PoB), Proof-of-Stake (PoS), and Proof-of-Elapsed Time (PoET), Life of a miner, Mining difficulty, Mining pool and its methods | 6 | 15% |
| Learning Outcome | 1. Define key concepts related to cryptocurrencies, including Bitcoin, Altcoins, and Tokens. *(Knowledge)* 2. Explain the functionality and types of cryptocurrency wallets. *(Comprehension)* 3. Describe the processes involved in cryptocurrency transactions. *(Application)* 4. Analyze different consensus mechanisms in Bitcoin, such as PoW and PoS. *(Analysis)* 5. Discuss the life of a miner and mining pool methods. *(Evaluation)* 6. Evaluate security concerns and solutions related to double spending. *(Synthesis)* | | |
| 3 | **Programming for Blockchain**  Introduction to Smart Contracts, Types of Smart Contracts, Structure of a Smart Contract, Smart Contract Approaches, Limitations of Smart Contracts  Introduction to Programming: Solidity Programming – Basics, functions, Visibility and Activity Qualifiers, Address and Address Payable, Bytes and Enums, Arrays-Fixed and Dynamic Arrays, Special Arrays-Bytes and strings, Struct, Mapping, Inheritance, Error handling | 8 | 20% |
| Learning Outcome | 1. Define what a smart contract is and its purpose in blockchain. *(Knowledge)* 2. Differentiate between types of smart contracts and their applications. *(Comprehension)* 3. Develop and deploy basic smart contracts using Solidity. *(Application)* 4. Analyze the structure and components of a smart contract. *(Analysis)* 5. Identify the limitations and challenges of smart contracts. *(Evaluation)* 6. Apply error handling and inheritance concepts in Solidity programming. *(Synthesis)* | | |
| 4 | **Public Blockchain**  Introduction to Public Blockchain, Ethereum and its Components, Mining in Ethereum, Ethereum Virtual Machine (EVM), Transaction, Accounts, Architecture and Workflow, Comparison between Bitcoin and Ethereum  Types of test-networks used in Ethereum, Transferring Ethers using Metamask, Mist Wallet, Ethereum frameworks, Case study of Ganache for Ethereum blockchain. Exploring etherscan.io and ether block structure | 8 | 20% |
| Learning Outcome | 1. Describe the components and architecture of Ethereum as a public blockchain. (Knowledge) 2. Explain the process of mining in Ethereum and the role of the Ethereum Virtual Machine (EVM). (Comprehension) 3. Compare and contrast Bitcoin and Ethereum blockchains. (Application) 4. Use tools like Metamask and Mist Wallet for transferring Ethers and managing transactions. (Analysis) 5. Analyze the structure of Ether blocks and explore etherscan.io. (Evaluation) 6. Evaluate and propose different test-networks used in Ethereum for specific applications. (Creation) | | |
| 5 | **Private Blockchain**  Introduction, Key characteristics, Need of Private Blockchain, Smart Contract in a Private Environment, State Machine Replication, Consensus Algorithms for Private Blockchain - PAXOS and RAFT, Byzantine Faults: Byzantine Fault Tolerant (BFT) and Practical BFT  Introduction to Hyperledger, Tools and Frameworks, Hyperledger Fabric, Comparison between Hyperledger Fabric & Other Technologies  Hyperledger Fabric Architecture, Components of Hyperledger Fabric: MSP, Chain Codes, Transaction Flow, Working of Hyperledger Fabric, Creating Hyperledger Network, Case Study of Supply Chain Management using Hyperledger | 8 | 20% |
| Learning Outcome | 1. List the key characteristics and necessity of private blockchains. (Knowledge) 2. Explain the implementation of smart contracts in a private blockchain environment. (Comprehension) 3. Describe state machine replication and consensus algorithms like PAXOS and RAFT. (Application) 4. Understand Byzantine Faults and Byzantine Fault Tolerant (BFT) systems. (Analysis) 5. Explain the architecture and components of Hyperledger Fabric. (Evaluation) 6. Create and manage a Hyperledger Network, with a case study on supply chain management. (Creation) | | |
| 6 | **Tools and Applications of Blockchain**  Corda, Ripple, Quorum and other Emerging Blockchain Platforms, Blockchain in DeFi: Case Study on any of the Blockchain Platforms. | 3 | 10% |
| Learning Outcome | 1. Identify the architecture and applications of emerging blockchain platforms like Corda, Ripple, and Quorum. (Knowledge) 2. Explain the role of blockchain technology in Decentralized Finance (DeFi). (Comprehension) 3. Analyze case studies of blockchain platforms used in DeFi applications. (Application) 4. Compare and contrast the advantages and limitations of different emerging blockchain platforms. (Analysis) 5. valuate the integration of blockchain technology in various financial and non-financial sectors. (Evaluation) 6. Explore future trends and propose potential developments in blockchain technology. (Creation) | | |
| **Total** | | **39** | **100%** |

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| **2.b** | **Prerequisite Courses** |

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| No. | Semester | Name of the Course | Topic/s |
| 1 | 1 | Data Structures | Linked List, Hashing |
| 2 | 5 | Cryptography | Cryptography, Digital Signatures |

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| **2.c** | **Relevance to Future Courses** |

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| No. | Semester | Name of the Course |
| 1 | VIII | Distributed Computing |
| 2 | VIII | Major Project-II |

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| **2.d** | **Identify real life scenarios/examples which uses the knowledge of the subject (Discussion on how to prepare examples and case studies e.g.** [**“Boeing Plane”: C Programming Language – Intro to Computer Science – Harvard’s CS50 (2018) – Bing video**](https://www.youtube.com/watch?v=ix5jPkxsr7M)**)** |  |

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| Real Life Scenario | Concept Used |
| Walmart and IBM Food Trust | Walmart uses IBM's Food Trust blockchain to track the origin and journey of food products. This system ensures transparency, traceability, and quick identification of contaminated products, enhancing food safety and quality control. |
| Ripple and Santander Bank | Santander Bank uses Ripple's blockchain technology for its One Pay FX service, enabling secure, fast, and low-cost cross-border payments. This service improves efficiency by reducing transaction times and fees compared to traditional banking methods. |
| Estonia's e-Health System | Estonia has implemented a blockchain-based system for storing and managing citizens' healthcare records. This ensures secure, decentralized access to medical data, allowing patients and authorized doctors to update and retrieve health information without compromising privacy.. |
| Everledger and Diamond Tracking | Everledger uses blockchain to track the provenance of diamonds, ensuring their authenticity and ethical sourcing. By creating a digital ledger of each diamond's history, from mining to sale, the platform helps prevent fraud and supports responsible sourcing practices. |

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| **3** | **Past Results – Division-Wise** |

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| --- | --- | --- | --- | --- |
| Details | Target – Dec 2024 | Dec 2023 | Dec 2022 | Dec 2021 |
| Course Passing % – Average of 2 Divisions | 100% | 100% | 100% | NA |
| Marks Obtained by Course Topper  (Marks/100) | 100/100 | 100/100 | 96/100 | NA |

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| --- | --- | --- | --- | --- |
|  | Division A | | Division B | |
| Year | Initials of Teacher | % Result | Initials of Teacher | % Result |
| Dec 2023 | SSO | 100% | SSO | 100% |
| Dec 2022 | DM | 100% | DM | 100% |
| Dec 2021 | NA | NA | NA | NA |

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| **4** | **All the Learning Resources – Books and E-Resources** |

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| **4.a** | **List of Text Books (T – Symbol for Text Books) to be Referred by Students** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sr. No | Text Book Titles | Author/s | Publisher | Edition | Module Nos. |
| 1 | Blockchain Technology, | Chandramouli Subramanian, Asha A. George, Abhillash K. A and Meena Karthikeyen, | Universities Press | -- | 1,2,3,4,5,6 |
| 2 | Mastering Ethereum, Building Smart Contract and Dapps | Andreas M. Antonopoulos Dr. Gavin Wood | O‘reilly. | -- | 1,2,3,4 |
| 3 | Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, | Imran Bashir | Packt Publishing | 3rd Edition, | 1,2,3,4 |

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| **4.b** | **List of Reference Books (R – Symbol for Reference Books) to be Referred by Students** |

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| Sr. No | Reference Book Titles | Author/s | Publisher | Edition | Module Nos. |
| 1 | Blockchain for Beginners | Yathish R and  Tejaswini N, | SPD | -- | 1,2,3,4 |
| 2 | Blockchain Basics, A Non Technical Introduction in 25 Steps | Daniel Drescher, | Apress. | -- | 1,2,3 |
| 3 | Blockchain with Hyperledger Fabric | Luc Desrosiers, Nitin Gaur, Salman A. Baset, Venkatraman Ramakrishna | Packt Publishing | -- | 1,5,6 |

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| **4.c** | **List of E - Books (E – Symbol for E-Books) to be Referred by Students** |

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| Sr. No | E- Book Titles | Author/s | Publisher | Edition | Module Nos. |
| 1 | Mastering Bitcoin: Programming the Open Blockchain | Andreas M. Antonopoulos | O'Reilly Media | 2nd | 1,2 |
| 2 | Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World | Don Tapscott and Alex Tapscott | Portfolio | 1st | All |
| 3 | The Basics of Bitcoins and Blockchains | Anthony Lewis | Independently published | 1st | 1,2,3 |
| 4 | Blockchain Bubble or Revolution: The Future of Bitcoin, Blockchains, and Cryptocurrencies | Aditya Agashe, Neel Mehta, and Parth Detroja | Paravane Ventures | 1st | 1,2,3 |

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| **4.d** | **Reading latest / top rated research papers (at least 5 papers)** |

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| --- | --- | --- | --- | --- |
| Name of Paper | Name of Authors (Background) | Published in | | Problem Statement |
| Date | Journal |
| Blockchain and the Future of the Internet: A Comprehensive Review | Fakhar ul Hassan, Anwaar Ali, Mohamed Rahouti, Siddique Latif, Salil Kanhere, Jatinder Singh, Ala Al-Fuqaha, Umar Janjua, Adnan Noor Mian, Junaid Qadir, Jon Crowcroft | 13 Nov 2020 | arXiv.org | This paper reviews the impact of blockchain technology on the future internet infrastructure, exploring decentralized systems and their potential to revolutionize data security and privacy. |
| Expedition to the Blockchain Application Potential for Higher Education Institutions | Matthias Gottlieb, Christina Deutsch, Felix Hoops, Hans Pongratz, Helmut Krcmar | April 2024 | Blockchain: Research and Applications | This study investigates the potential applications of blockchain technology in higher education, focusing on improving administrative efficiency and enhancing student services. |
| Expedition to the Blockchain Application Potential for Higher Education Institutions | Matthias Gottlieb, Christina Deutsch, Felix Hoops, Hans Pongratz, Helmut Krcmar | April 2024 | Blockchain: Research and Applications | This study investigates the potential applications of blockchain technology in higher education, focusing on improving administrative efficiency and enhancing student services. |
| Ethereum-Based Information System for Digital Higher Education Registry and Verification of Student Achievement Documents | Yerlan Kistaubayev, Galimkair Mutanov, Madina Mansurova, Zhanna Saxenbayeva, Yassynzhan Shakan | December 2022 | Future Internet (MDPI) | This paper develops a platform for the unified digital register of students’ educational achievements using the Ethereum blockchain architecture, addressing performance criteria such as throughput and transaction costs. |
| Identity Management and Authentication of a UAV Swarm Based on a Blockchain | Pengbin Han, Aina Sui, Jiang Wu | October 2022 | Applied Sciences (MDPI) | This study proposes a blockchain-based identity management model for UAV swarms to address security issues such as single points of failure and lack of reliable identity authentication. |

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| **4.e** | **Based on research paper an identify the current Problem statement** |

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| Problem Statement | Used in | | | | | | |
| Quiz | Assignment | Lab | Mini Project | Poster Presentation | Test | Any Other |
| Enhancing Internet Security and Privacy through Blockchain: Challenges and Solutions | -- | √ | √ | √ | √ | -- | -- |
| Transforming Higher Education Administration with Blockchain Technology | -- | √ | -- | √ | √ | -- | -- |
| Designing an Ethereum-Based System for Student Achievement Document Verification | -- | √ | -- | √ | -- | -- | -- |
| Blockchain-Based Identity Management for UAV Swarms: Advantages and Implementation | -- | √ | -- | √ | -- | -- | -- |
| Decentralizing the Internet with Blockchain: Control, Governance, and User Autonomy | -- | √ | -- | √ | -- | -- | -- |

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| **4.f** | **Identify Companies / Industries which use the knowledge of the subject and thus may provide Internships and final Placements** |

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| --- | --- | --- | --- |
| Name of the Company | To be / Contacted for | | |
| Student Internship | Student Final Placement | Faculty Internship |
| BuildBear Labs | √ | -- | -- |

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| **4.g** | **Identify suitable relevant TOP Guest Speakers from Industry (CS50 Lecture by Mark Zuckerberg - 7 December 2005 - YouTube)** |

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| Name of the Identified Guest Speaker | Designation | Name of the Company |
| Dipesh Sukhani  https://www.linkedin.com/in/dipeshsukhani/ | Co-Founder | BuildBear Labs |

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| **4.h** | **Identify relevant Technical competitions to participate [Competitions -Paper Presentations, Projects, Hackathons, IVs etc..]** |

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| Name of the Relevant Technical Competition Identified to participate | Organized by | Date of the Event |
| International Blockchain Olympiad (IBCOL) 2024 | Link: [IBCOL 2024](https://www.ibcol.org/) | November 11, 2024 |

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| **4.i** | **Identify faculty in TOP schools / Universities who are teaching same / similar subject and develop rapport e.g. Exchange Lecture Material (Assignments / Tests / Project etc..), Joint Paper Publication** |

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| --- | --- | --- | --- | --- | --- |
| University | Name of the Course | Name of Faculty | Type of Collaboration | | |
| Exchange of Lecture Material | Joint Publication/ Research | Other |
| IIT Bombay | Cryptocurrency and Blockchain Technologies  <https://www.ee.iitb.ac.in/web/course_lists/ee-465-cryptocurrency-and-blockchain-technologies/> | [Saravanan Vijayakumaran](http://www.ee.iitb.ac.in/~sarva) | √ | -- | -- |

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| **4.j** | **Module Best Available in - Title best resource [from *4.a* to *4.d* in this AAP] & give details** |

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| --- | --- | --- | --- | --- | --- | --- |
| Module No. | Title of the Module | Web Link | Mention the Tile | | | |
| Journal | E-Journal | Magazine | Other Resource |
| 1 | Introduction to Blockchain | https://www.geeksforgeeks.org/blockchain-technology-introduction/ | -- | -- | -- | T1 |
| 2 | Cryptocurrency | https://www.investopedia.com/terms/c/cryptocurrency.asp | -- | -- | -- | T1 |
| 3 | Programming for Blockchain | https://www.geeksforgeeks.org/top-10-programming-languages-for-blockchain-development/ | -- | -- | -- | T1 |
| 4 | Public Blockchain | https://www.geeksforgeeks.org/public-blockchain/?ref=gcse | -- | -- | -- | T1 |
| 5 | Private Blockchain | https://www.geeksforgeeks.org/private-blockchain/?ref=lbp | -- | -- | -- | T1 |
| 6 | Tools and Applications of Blockchain | https://geekflare.com/blockchain-development-tools/ | √ | -- | -- | -- |

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| **4.k** | **Referred to any top-rated university in that subject for content** |

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| --- | --- | --- | --- | --- |
| University | Name of the Course | Name of Faculty | Date of Delivery of the Course | Remarks |
| MIT | Blockchain:  Disruptive Technology | Dr. Abel Sanchez  Prof. John R. Williams | Starts from  July 9, 2024  (8 Weeks Online) | https://online.professionalprogramsmit.com/blockchain?utm\_source=Google&utm\_medium=c&utm\_term=mit%20certificate%20courses&utm\_location=1007785&utm\_network=g&utm\_campaign=B-99999\_WW\_GG\_SE\_MPE\_Brand\_Generic\_ROW&utm\_content=brand-generic-row&gad\_source=1&gclid=Cj0KCQjw4MSzBhC8ARIsAPFOuyW3SUpO2xCnP5dhW3VEEXVS-05UyP9NWC0Iu4mLJ08RKmaEV2TsWFkaAp8vEALw\_wcB |

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| **4.l** | **Faculty received any certification related to this subject. List of Certifications Identified / Done** |

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| Course | Certifying Agency | No. of Hours | Level of the Course | | Certification | | Remarks |
| Introductory | Advance Skill Development | Done on | Proposed to be on |
| Blockchain  (Specialization) | Coursera | 4 months at 4 hours a week | -- | √ | 05/30/2020 | -- | coursera.org/verify/specialization/NE9VB9V5WJPZ |

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| **4.m** | **Completed subject wise/cluster wise training with cluster mentor.**  **List of relevant Refresher Course Identified / Done** |

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| --- | --- | --- | --- | --- |
| Course | Certifying Agency  (As suggested by DAB/Cluster Mentor/Industry/University other than MU) | Certification | | Remarks |
| Done on | Proposed to be on |
| Pedagogy | LinkedIn Learning | 09/04/2020 | -- | Teaching with Technology |
| edX | June 2020 | -- | How to Learn Online by edX |
| PBL | Infosys Springboard | October 2023 | -- | Course on “Introduction to Ethereum Blockchain” |
| upGrad | 22/05/2020 | -- | Introduction to Blockchain |
| Sub. Content Training | Coursera | 05/10/2020 | -- | Smart Contract |
| Coursera | 20/05/2020 | -- | Decentralized Applications (Dapps) |

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| **4.n** | **Best Practices Identified and adopted** |

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| --- | --- | --- | --- | --- |
| No. | Item | Best Practices Identified | | |
| Univ. 1: MIT | Univ. 2: University at Buffalo | Univ. 3: IIT Kanpur |
| 1 | Microsite | -- | -- | -- |
| 2 | Video Lectures | √ | √ | √ |
| 3 | Assignments | √ | √ | √ |
| 4 | Mini Project | -- | -- | -- |
| 5 | Assessment Metric | -- | -- | -- |
| 6 | Quizzes | -- | √ | √ |
| 7 | Labs/ Practical (PBL) | -- | √ | -- |
| 8 | Tests | -- | -- | -- |
| 9 | Peer Assessment | -- | -- | -- |
| 10 | Any Other | -- | -- | -- |

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| **4.o** | **Web Links for Online Notes/YouTube/VIT Digital Content/VIT Lecture Capture/NPTEL Videos** |

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| No. | Websites / Links | Module Nos. |
| 1 | YouTube: https://www.youtube.com/playlist?list=PLnSSXZGxkrZuvI533Jbqu2-RxEjcAOhkV | 1,2,3 |
| 2 | MIT: https://www.youtube.com/watch?v=EH6vE97qIP4&list=PLUl4u3cNGP63UUkfL0onkxF6MYgVa04Fn | 1,2 |
| 3 | NPTEL: https://onlinecourses.swayam2.ac.in/aic21\_ge01/preview | 1,2,3,4,5 |

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| **4.p** | **Recommended MOOC Courses like Coursera / NPTEL / MIT-OCW / edX/VAC etc.** |

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| --- | --- | --- | --- | --- |
| Sr. No. | MOOC Course Link | Course conducted by – Person / University / Institute / Industry | Course Duration | Certificate (Y / N) |
| 1 | **Blockchain for Enterprises** https://infyspringboard.onwingspan.com/web/en/app/toc/lex\_auth\_013038627363602432360\_shared/overview | Infosys Springboard | 11h 12m | Yes |

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| **5** | **Consolidated Course Lesson Plan** |

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|  | From (date/month/year) | To (date/month/year) | Total Number of Weeks |
| Semester Duration | 08/07/2024 | 18/10/2024 | 15 |

| Week | Lecture no. | Module No. | Lecture Topics / IA 1 and IA 2 / BSA planned to be covered | Actual date of Completion  (Hand written) | COs  Mapped | Recommended  Prior Viewing / Reading | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Lecture No. (on LMS) | Chapter No./ Books/ Web Site |
| 1 | 1,2 | 1 | What is a blockchain, Origin of blockchain |  | CO1 |  | T1  Pg. 1-5 |
| 3 | 1 | Foundation of blockchain: Merkle trees |  | CO1 |  | T1  Pg. 196 |
| 2 | 4,5 | 1 | Components of blockchain, Block in blockchain, Types: Public, Private, and Consortium |  | CO1 |  | T1  Pg. 15-19  Pg. 53-57 |
| 6 | 1 | Consensus Protocol, Limitations and Challenges of blockchain |  | CO1 |  | T1  Pg. 64-72  Pg. 26-27 |
| 3 | 7,8 | 2 | Cryptocurrency: Bitcoin, Altcoin, and Tokens (Utility and Security), Cryptocurrency wallets: Hot and cold wallets |  | CO2 |  | T1  Pg. 100-103  Pg. 16-17 |
| 9 | 2 | Cryptocurrency usage, Transactions in Blockchain, UTXO and double spending problem |  | CO2 |  | T1  Pg. 106-115  Pg. 24-25 |
| 4 | 10,11 | 2 | Bitcoin blockchain: Consensus in Bitcoin, Proof-of-Work (PoW), Proof-of-Burn (PoB), Proof-of-Stake (PoS), and Proof-of-Elapsed Time (PoET) |  | CO2 |  | T1  64-72 |
| 12 | 2 | Life of a miner, Mining difficulty, Mining pool and its methods |  | CO2 |  | T1  Pg. 141-146 |
| 5 | 13,14 | 3 | Introduction to Smart Contracts, Types of Smart Contracts, Structure of a Smart Contract |  | CO3 |  | T1  Pg. 225-235 |
| 15 | 3 | Smart Contract Approaches, Limitations of Smart Contracts |  | CO3 |  | T1  Pg. 237-239 |
| 6 | 16,17 | 3 | Introduction to Programming: Solidity Programming – Basics, functions, Visibility and Activity Qualifiers |  | CO3 |  | T1  Pg. 553-575 |
| 18 | 3 | Address and Address Payable, Bytes and Enums, Arrays-Fixed and Dynamic Arrays, Special Arrays-Bytes and strings, Struct, Mapping, Inheritance, Error handling |  | CO3 |  | T1  Pg. 583-594 |
| 7 | 19,20 | 3 | Case Study – Voting Contract App, Preparing for smart contract development |  | CO3 |  | T1  Pg. 443-444 |
| 21 | 4 | Introduction to Public Blockchain, Ethereum and its Components, Mining in Ethereum, Ethereum Virtual Machine (EVM) |  | CO4 |  | T1  Pg. 179-196 |
| 8 | 22,23 | 4 | Transaction, Accounts, Architecture and Workflow, Comparison between Bitcoin and Ethereum |  | CO4 |  | T1  Pg. 197-200 |
| 24 | 4 | Types of test-networks used in Ethereum, Transferring Ethers using Metamask |  | CO4 |  | T2  Pg. 131-134 |
| 9 | 25,26 | 4 | Mist Wallet, Ethereum frameworks, Case study of Ganache for Ethereum blockchain. |  | CO4 |  | T2  Pg. 265-270 |
| 27 | 4 | Exploring etherscan.io and ether block structure |  | CO4 |  | T2  Pg. 21-22 |
| 10 | 28,29 | 5 | Introduction, Key characteristics, Need of Private Blockchain, Smart Contract in a Private Environment, State Machine Replication |  | CO5 |  | T1  Pg. 250-275 |
| 30 | 5 | Consensus Algorithms for Private Blockchain - PAXOS and RAFT, Byzantine Faults: Byzantine Fault Tolerant (BFT) and Practical BFT |  | CO5 |  | T1  Pg. 276-298 |
| 11 | 31,32 | 5 | Introduction to Hyperledger, Tools and Frameworks, Hyperledger Fabric |  | CO5 |  | T1  Pg. 320=324 |
| 33 | 5 | Comparison between Hyperledger Fabric & Other Technologies |  | CO5 |  | T1  Pg. 328-332 |
| 12 | 34,35 | 5 | Hyperledger Fabric Architecture, Components of Hyperledger Fabric: MSP, Chain Codes, Transaction Flow, Working of Hyperledger Fabric |  | CO5 |  | T1  Pg. 333-348 |
| 36 | 5 | Creating Hyperledger Network, Case Study of Supply Chain Management using Hyperledger |  | CO5 |  | T1  Pg. 475-481 |
| 13 | 37,38 | 6 | Corda, Ripple, Quorum and other Emerging Blockchain Platforms |  | CO6 |  | T1  Pg. 333-334 |
| 39 | 6 | Blockchain in DeFi: Case Study on any of the Blockchain Platforms |  | CO6 |  | T1  Pg. 444-450 |

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| **6** | **Rubric for Grading and Marking of ISA (Theory and Lab)** |

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| Theory (ISA=20 Marks) | | | | | | Practical (ISA= 25 Marks) | | | | |
| TP Assignments (4) | POP Quizzes  (3) | THT  (1) | Paper Review Activity (1) | Poster Presentation  (1) | Lab Participation | | Lab Work | PBLE Implementation | Certification Course | Mini Project |
| 08 Marks | 06 Marks | 02 Marks | 02 Marks | 02 Marks | 05 Marks | | 05 Marks | 05 Marks | 05 Marks | 05 Marks |

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| **7** | **Assignments / Tutorials Details** |

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| Assignment/ Tutorial No. | Title of the Assignments / Tutorials | CO Map | Assignment/ Tutorials given to Students on | Week of Submission |
| 1 | Assignment #1: Introduction to Blockchain | CO1 | 2nd Week | 3rd Week |
| 2 | Assignment #2: Cryptocurrency | CO2 | 3rd Week | 4th Week |
| 3 | Assignment #3: POP Quiz-Cryptocurrency | CO2 | 4th Week | 5th Week |
| 4 | Assignment #4: Programming for Blockchain | CO3 | 5th Week | 6th Week |
| 5 | Assignment #5: POP Quiz- Programming for Blockchain | CO3 | 6th Week | 7th Week |
| 6 | Assignment #6: Public Blockchain | CO4 | 7th Week | 8th Week |
| 7 | Assignment #7: POP Quiz- Public Blockchain | CO4 | 8th Week | 9th Week |
| 8 | Assignment #8: Private Blockchain | CO5 | 9th Week | 10th Week |
| 9 | Assignment #9: Take Home Test | CO1 | 10th Week | 11th Week |
| 10 | Assignment #10: Paper Review Activity- Tools and Applications of Blockchain | CO6 | 11th Week | 12th Week |
| 11 | Assignment #11: Poster Presentation on “Tools and Applications of Blockchain” | CO6 | 12th Week | 13th Week |

**Analysis of Assignment / Tutorial Questions and Related Resources**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Assignment / Tutorial No. | Week No. | Type\* (√) | | | Module No. | Based on # | | | Question Type (√) | |
| R | PQ | THT | Text Book | Reference  Book | Other Learning Resource | MU EQ | Thought Provoking |
| 1 | 2 | √ | -- | -- | 1 | √ | √ | E-Book #1  Website #1 | -- | √ |
| 2 | 3 | √ | -- | -- | 2 | √ | √ | E-Book #1  Website #1 | -- | √ |
| 3 | 4 | -- | √ | -- | 2 | √ | √ | E-Book #1  Website #1 | √ | -- |
| 4 | 5 | √ | -- | -- | 3 | √ | √ | E-Book #1  Website #1 | -- | √ |
| 5 | 6 | -- | √ | -- | 3 | √ | √ | E-Book #1  Website #1 | √ | -- |
| 6 | 7 | √ | -- | -- | 4 | √ | √ | E-Book #1  Website #1 | -- | √ |
| 7 | 8 | -- | √ | -- | 4 | √ | √ | E-Book #1  Website #1 | √ | -- |
| 8 | 9 | √ | -- | -- | 5 | √ | √ | Web Link #5 | -- | √ |
| 9 | 10 | -- | -- | √ | 5 | √ | √ | 4.d. Latest / top rated research papers | -- | √ |
| 10 | 11 | √ | -- | -- | 6 | √ | √ | Web Link #6 | -- | √ |
| 11 | 12 | √ | -- | -- | 6 | √ | √ | Web Link #6 | -- | √ |

\* Tick (√) the Type of the Assignment: Regular (R); Pop Quiz (PQ) ; Open Book Test for TE/BE/ME (OBT)

# Write number for text book, reference book, other learning resource from this AAP – *from* *Points 4.a to 4.d*

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| **8** | **Weekly Test / Other Class Test / Open Book Test (OBT)/Take Home Test (THT) Details** |

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| Tests | Test Dates | Module No. | CO Map | MSE Question Paper Pattern | Policy |
| MSE-1 | 7th Week | 1, 2, 3 | CO1, CO2, CO3 | Q.1. Solve 5 out of 7 (2 Marks)  Q.2. Solve 2 out of 3 (5 Marks)  Q.3. Solve 1 out of 2 (10 Marks) | MSE Remake test at the end of semester |
| MSE-2 | 14th Week | 4, 5, 6 | CO4, CO5, CO6 | Q.1. Solve 5 out of 7 (2 Marks)  Q.2. Solve 2 out of 3 (5 Marks)  Q.3. Solve 1 out of 2 (10 Marks) | MSE Remake test at the end of semester |
| Pop Quiz | 4th Week  6th Week  8th Week | 2, 3, 4 | CO2, CO3, CO4 | MCQ based (10 Questions) | -- |
| Take Home Test | 12th Week | 1 | CO1 | Attempt any 3 questions out of 5 questions.  Each question carries 05 Marks | -- |

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| **9.a** | **Practical Activities** |

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| Practical No. | Module No. | Title of the **Experiments** | Type of Experiment | | Topics to be highlighted | CO Map |
| PBL | Newly Added |
| 1 | 03 | Introduction to Ethereum and Setting Up MetaMask | -- | √ | Programming in blockchain | CO3 |
| 2 | 03 | Writing and Deploying a Simple Smart Contract using Remix IDE | -- | √ | Programming in blockchain | CO3 |
| 3 | 03 | Interacting with Deployed Smart Contracts | -- | √ | Programming in blockchain | CO3 |
| 4 | 03 | Developing a Simple Token Contract | -- | √ | Programming in blockchain | CO3 |
| 5 | 04 | Building a Decentralized Application (DApp) Interface | -- | √ | Public Blockchain | CO4 |
| 6 | 04 | Case Study - Real-World Application of Ethereum (e.g., DeFi application, supply chain management) | -- | √ | Public Blockchain | CO4 |
| 7 | 04 | Implementing Smart Contract Security | -- | √ | Public Blockchain | CO4 |
| 8 | 04 | Integrating MetaMask with DApp | -- | √ | Public Blockchain | CO4 |
| 9 | 04 | Advanced Smart Contract Development (e.g., a voting system) | -- | √ | Public Blockchain | CO4 |
| 10 | 3, 4 | **Implementing a Simple Voting System**  In this experiment, students will develop a decentralized voting application using Ethereum blockchain to ensure the security and transparency of the voting process. Using Remix IDE, students will write a Solidity smart contract that includes functionalities for registering candidates, allowing users to cast votes, and tallying votes. They will then deploy the smart contract on a test network using MetaMask. The recommended inputs include candidate names and voter addresses. The expected output is a secure, immutable record of votes, with a tally that can be verified for accuracy and integrity. By the end of this experiment, students will understand how to implement basic blockchain applications that provide transparency and prevent fraud in voting systems. | √ | -- | Programming in Blockchain, | CO3 |
| 11 | 3, 4 | **Tracking Supply Chain Transactions**  This experiment involves creating a blockchain-based system to track product movement through a supply chain, ensuring transparency and traceability. Students will write a Solidity smart contract using Remix IDE to register products and log transactions as products move through the supply chain stages (e.g., manufacturer, distributor, retailer). They will deploy the smart contract on a test network with MetaMask integration. The recommended inputs are product IDs and transaction details (e.g., timestamps, locations). The expected output is an immutable ledger of product transactions that can be audited for accuracy, enhancing the transparency and trustworthiness of the supply chain process. Students will gain practical experience in applying blockchain technology to real-world scenarios, improving their understanding of its benefits in supply chain management. | √ | -- | Public blockchain | CO4 |

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| **10** | **Beyond Syllabus Activities for Gap Mitigation** |

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| No. | Type of the Activity | Activities | Number of beneficiaries | Other Details – guest profile, feedback, mark sheet, report |
| 1 | **Experiential learning/Interaction with Outside World** | 1- Guest Lectures by Industry Expert |  | Guest lecture of industry expert based on “Application of Blockchain” |
| 2- Workshops |  | -- |
| 3- Mini Project |  | Mini Project based on entire syllabus will be evaluated by subject teacher |
| 4- Industrial Visit |  | -- |
| 5- Any other activity |  | -- |
| 2 | **Collaborative & Group Activity** | 6- Poster Presentation |  | Students need to prepare posters based on Chapter #6 of Blockchain syllabus |
| 7- Minute Papers |  | Minute paper activity will be conducted on specific topic or on entire syllabus |
| 8- Students Seminars |  | -- |
| 9- Students Debates |  | -- |
| 10- Panel Discussion / Mock GD |  | -- |
| 11- Mock Interview |  | -- |
| 12- Any other activity |  | -- |
| 3 | **Co-Curricular Activity** | 13- Informative videos (NPTEL/Youtube /TEDx/ MIT OW/edX) |  | NPTEL/ YouTube videos on a specific topic will be shown to students on the topic “Blockchain Use Cases” |
| 14- Lecture Capture Usage |  | All lecture recordings are made available to students via MS Teams |
| 15-Any other activity |  | -- |
| 4 | **Tests & Assessments** | 16- Class Tests/ Weekly Tests |  | -- |
| 17- Pop Quiz |  | 3 Pop Quizzes will be conducted based on Chapter #3, #4 and #5 of Syllabus |
| 18- Mobile App Based Quiz |  | -- |
| 19- Open Book Test |  | -- |
| 20- Take Home Test |  | 1 THT will be conducted based on Chapter #1 of Syllabus |
| 21-Any other activity |  | -- |

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| **11** | **AAP/ Lecture Guide** |

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| No. | Programme | Course | Uploaded on V-refer | Date |
| 1 | Computer Engineering | Blockchain | 12/07/2024 | 10/07/2024 |

Consolidated Academic Administration PlanPrepared by (mention all theory teaching faculty names with signature)

Please write below your name and sign with date of the external cluster mentor meeting

|  |
| --- |
| Swapnil Sonawane |

|  |  |  |  |
| --- | --- | --- | --- |
| External Industry Mentor | External Academic Mentor | VIT Cluster Mentor | Program HOD |