



Kadi Sarva Vishwavidyalaya
Faculty of Engineering & Technology
Fourth Year Bachelor of Engineering (Computer/IT)
(To be Proposed For: Academic Year 2020-21)

Subject Code: CT703D-N	Subject Title: Blockchain Technology
Pre-requisite	

Teaching Scheme (Credits and Hours)

Teaching scheme				Total Credit	Evaluation Scheme					Total
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
04	00	02	06	05	03	70	30	20	30	150

Motivation/Acknowledgement:

NPTTEL Course on “BLOCKCHAINS ARCHITECTURE, DESIGN AND USE CASES” by Sandip Chakraborty, Computer Science and Engineering, IIT Kharagpur and Praveen Jaychandran IBM Research, INDIA

Course Objective:

- The primary objective of this course is to make the students familiar with such emerging technologies
- Students are expected to understand the cryptographic concept behind the Blockchain technology and differentiate the technical aspect of Blockchain with that of Bitcoin commercial aspect.
- Students are supposed to understand and learn the use-cases and applications aspects of Blockchain with implementation options
- Students are also anticipated to understand what is a smart contract and how to write it.

Outline of the Course:

Sr. No	Title of the Unit	Minimum Hours
1	Background Theories	8
2	Bitcoin	8
3	Introduction to Blockchain	8
4	Consensus	8
5	Mining	6
6	Permissioned Blockchain	7
7	Blockchain Use cases	7
8	Smart Contract	8
9	Research in Blockchain	4

Total hours (Theory):64

Total hours (Lab):32

Total hours:96



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Detailed Syllabus

No	Topic	Lecture (Hrs)	Weightage (%)
1	Background Theories: Cryptographic Hash Functions (SHA), Cryptographically Secured, Digital Signature, Public Key Cryptography (RSA), Chain of Blocks, Merkle Trees, Smart Contract, Centralized Vs. Distributed network. Actors and components in Blockchain solution.	8	13
2	Bitcoin: Basics, Creation/Projections of Coins, Double-spending attack, Bitcoin Anonymity, Basics of Bitcoin Script (FORTRAN), Bitcoin transactions through script.	8	13
3	Introduction to Blockchain: A typical block structure, chain of block, distributed ledger, Permissioned and Permission-less Model, Constructing a chain, Orphan block, Block propagation, Introduction to mining	8	13
4	Consensus: Why consensus, Distributed consensus, Consensus in Synchronous and Asynchronous systems, Consensus in Bitcoin, Proof of Work (PoW) Protocol, Attacks: Double spending, Sybil, DoS. Other consensus mechanism: Proof of Stake, Proof of Burn, Proof of Elapsed Time.	8	13
5	Mining: What is mining, Mining Difficulty, Miner, Mining pool, Mining pool methods	6	9
6	Permissioned Blockchain: Use cases, smart contracts, Limitations, State machine replication, crowd funding. Consensus algorithm: PAXOS, RAFT. Byzantine Generals Problem. Practical Byzantine Fault Tolerant Model, Three Phase Commit Protocol	7	10
7	Blockchain Use Cases: Crowd funding, Compliance to KYC, International Trade finance, Supply Chain Management	7	10
8	Smart Contracts / Ethereum: Introduction, History, Architecture, Amount types, gas, transactions, Ethereum smart contract, Ethereum VM, Solidity, Limitations.	8	13
9	Research in Blockchain: Discussion of Latest research papers.	4	6
	Total	64	100

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, background theory of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.



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- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.
- As the topic is emerging, it is highly recommended to students for enrolling in one of the e-resources mentioned beneath.

Learning Outcome:

On successful completion of this course, the student should be able to:

- Understand the difference between Blockchain and Bitcoin
- Understand the strength and limitations of Blockchain
- Understand the Application domain and use-cases of Blockchain
- Understand consensus mechanism and mining process in Blockchain
- Implement small Blockchain experimentations
- Write small smart contracts
- Have introductory knowledge about Ethereum and Solidity

e-Resources:

- <https://nptel.ac.in/courses/106105184/> [BLOCKCHAINS ARCHITECTURE, DESIGN AND USE CASES]
- Udemy Courses: (a) Blockchain A-Z™: Learn How To Build Your First Blockchain (b) Ethereum Blockchain Developer: Build Solidity Projects (2020) (c) Blockchain 2020 - Complete Blockchain Course for Beginners
- CoursEra Courses: (a) Introduction to Blockchain Technologies (b) Blockchain: Foundations and Use Cases (c) Smart Contracts

Reference Books:

1. Alex Tapscott and Don Tapscott, "Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World", Penguin UK.
2. Daniel Drescher, "Blockchain Basics: A Non-Technical Introduction in 25 Steps", Apress.
3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly Media, Inc.
4. Tiana Laurence, "Blockchain For Dummies", John Wiley & Sons.
5. Imran Bashir, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", Packt Publishing Ltd.
6. Andreas Antonopoulos, "Mastering Ethereum: Building Smart Contracts and DApps", O'Reilly Media, Inc.
7. Chris Dannen, "Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programming for Beginners", Apress.
8. Mark Gates, "Blockchain: Ultimate guide to understanding Blockchain, bitcoin, cryptocurrencies, smart contracts and the future of money", CreateSpace Independent Publishing Platform



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List of Experiments

No	Name of Experiment
Part 1	1.1 Understanding Block using https://tools.superdatascience.com/Blockchain/block 1.2 Understanding Blockchain using https://tools.superdatascience.com/Blockchain/Blockchain 1.3 Understanding Distributed Blockchain using https://tools.superdatascience.com/Blockchain/distributed 1.4 Understanding Tokens using https://tools.superdatascience.com/Blockchain/tokens 1.5 Understanding coin based transaction using https://tools.superdatascience.com/Blockchain/tokens
Part 2	Using JavaScript Perform following (Source: YouTube Channel: Simply Explained – Savjee) 2.1 Creating a Blockchain 2.2 Implementing Proof-of-Work 2.3 Miner rewards & transactions 2.4 Signing transactions 2.5 Angular frontend
Part 3	Introduction to Geth: 3.1 Introduction to geth 3.2 Creation of private Blockchain 3.2 Creation of Account 3.4 Mining using geth
Part 4	Introduction to Remix Ethereum: 4.1 Introduction to Metamask 4.2 Creation of account using Metamask 4.3 Introduction to Remix Ethereum 4.4 Introduction to solidity program structure, compilation and deployment environment. 4.5 Write a smart contract in solidity to store and get “Hello World”. 4.6 Write a smart contract in solidity to create a function setter and getter to set and get a value. 4.7 Write a smart contract in solidity to print the array of integers and its length. 4.8 Write a solidity code to print array elements and its position.
Part 5	Introduction to Ethereum-Ganache: 5.1 Creation of account using Ganache. 5.2 Introduction to solidity smart contract compilation and deployment environment. 5.3 Write a smart contract in solidity to store and get “Hello World”.