GUJARAT TECHNOLOGICAL UNIVERSITY

Syllabus for Integrated Master of Computer Applications, 7th Semester
Subject Name: Block Chain Technology
Subject Code: 2678605

With effective from academic year 2020-21

1. Learning Objectives:

- To learn how blockchain systems works.
- To understand basic of the blockchain technology, challenges, gaps and problems.
- To develop proficiency in Design, build, and deploy smart contracts and distributed applications.
- Integrate ideas from blockchain technology into their own projects and apply to different aspects of the business.

2. Prerequisites:

Knowledge of Programming Language, Advanced Data Structure and Algorithms, Linux OS and fundamental knowledge of computer security and cryptography.

3. Course Contents:

Unit	Course Content	Weightage Percentage
Unit I	Basic of Blockchain : Basics of Block chain : Introduction, concepts of blockchain, Definition, fundamentals and characteristics of block chain, consensus in Trust building Exercises, Public, private and Hybrid Block chains, Distributed Ledger technologies, DLT decentralized applications and databases, Architecture of Block chain , Transactions, Chaining Blocks, Value Proposition of Blockchain Technology. Decentralized System: Distributed Decentralized databases, decentralized enterprise, Decentralization, Disintermediation Hash Functions: Introduction, hashing, Message Authentication code, Secure Hash Algorithms (SHA-1), SHA Version 3, Distributed hash tables, Hasing and Data Structures, Hashing in Blockchain Mining Consensus: Approach and Algorithms , Byzantine Agreement Methods	**20%**
Unit II	**Blockchain Components**: Introduction, Etherium (EtheriumVirual Machine, Clients, Key Pairs, Addresses, Wallets, Transactions, Languages and Development Tools). Cryptography: Introduction, Primitive, Symmetric and Asymmetric cryptography	**20%**
Unit III	**Smart Contracts**: Introduction, smart contracts, Absolute immutable, contractual confidentiality, Law implementation and sentiment, characteristics, IoT, Utilities (Smart grid), Proofs of origin, Supply chain management, Medical sciences, Finance, Media and entertainment, Public services, Legal Services, Darknet	**20%**
Unit IV	Bitcoins: Introduction, Working of Bitcoin, Merkle Trees, Bitcoin Block Structures, Bitcoin Address, Bitcoin Transactions, Bitcoin Network, BitcoinWallets, BitcoinPayments, Bitcoinclients, Bitcoinsupply	**20%**
Unit	Blockchain Applications and Allied Technologies	**20%**

V	Blockchain applications: Block chain in Insurance, Block chain in Healthcare, Life insurance and Claim Processing in Case of Death, Asset Management, Financial Institutional Assets, Smart Assets, Electronic currency, Manufacturing Blockchain and Allied Technologies:Blockchain and Cloud computing, Blockchain and Artificial Intelligence, Blockchain and IoT, Blockchain and Machine Learning, Blockchain and Robotic process automation	

4. Text Book:

- Blockchain Technology - Concepts and Applications: Kumar Saurabh, AshutoshSaxena, First Edition, Wiley

5. Reference Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder,Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, July, 2016
2. Imran Bashir , Mastering Blockchain 2nd Edition, , PACKT Publication
3. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
4. BikramadityaSinghal, GautamDhameja and PriyansuSekhar Panda,Beginning Blockchain, A Beginner's Guide to Building Blockchain Solutions, Apress, 2018
5. EladElrom,TheBlockchain Developer, A Practical Guide for Designing, Implementing, Publishing, Testing, and Securing Distributed Blockchain-based Projects, Apress, 2019
6. MerunasGrincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols", Packt Publishing.
7. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
8. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.
9. The future of financial infrastructure, an ambitious look at how blockchain can reshape financial services, The future of financial infrastructure, World Economic Forum, 2016
10. AljoshaJudmayer Nicholas Stifter Katharina Krombholz Edgar Weippl,Blocks and Chains, Introduction to Bitcoin, Cryptocurrencies, and their Consensus Mechanisms, 2017
11. Mastering Bitcoin, Programming the Open Blockchain, Andreas M. Antonopoulos, 2017

MOOC:

Prof. SandipChakraborty, Dr. Praveen Jayachandran, "Blockchain Architecture Design AndUse Cases" [MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184/**Professor Sandeep K. Shukla, Introduction to Blockchain Technology and Applications,**https://onlinecourses.nptel.ac.in/noc20_cs01/preview

6. Chapter wise Coverage from the Text Book:

Unit #	Book#	Chapter
I	1	Chapter 1 to 4
II	1	Chapter 5 and 6
III	1	Chapter 7
IV	1	Chapter 8
V	1	Chapter 10 and 11

7. Accomplishment of the student after completing the course:

1) Student will learn principles and techniques associated with blockchain technologies, they will become familiar with the cryptographic building blocks and how they are used in a typical cryptocurrency such as Bitcoin.
2) Students will develop a practical understanding of how cryptocurrencies are implemented and the practical limitations of currently available blockchain and cryptocurrency systems.
3) Apply hyperledger Fabric and Etherum platform to implement the Block chain Application.
4) Design, build, and deploy a distributed application.
5) Evaluate security, privacy, and efficiency of a given blockchain system.
6) Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.

8. Laboratory (desirable)

Student may form group and decide topic for study in addition to syllabus. Prepare white paper and preparation which include videos, animations, pictures, graphics for better understanding theory and practical work. The faculty may guide in identification of topic to groups of students so that the entire syllabus to be covered. The power-point slides may be uploaded on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide.

Suggested Application to work upon (list is suggestive but not limited to):

1. Block Chain Technology – Health Care Sector
2. Block Chain Technology – Digital ID
3. Block Chain Technology – Education Sector
4. Block Chain Technology – Agriculture Sector
5. Block Chain Technology – Supply Chain Management
6. Block Chain Technology – Food Safety
7. Block Chain Technology – Smart Cities
8. Block Chain Technology – Public Distributed System
9. Block Chain Technology – Hospitality Sector
10. Block Chain Technology – Insurance Sector
11. Block Chain Technology – Finance Industry
12. Block Chain Technology – Banking Industry