Kadi Sarva Vishwavidyalaya, Gandhinagar
MCA Semester III
MCA-36 D : Blockchain Technology

Rationale:
The primary objective of this course is to provide a broad introduction to Blockchain and its application. Blockchain is the distributed and decentralized database technology behind this crypto currency. This course explores the fundamentals of the public, transparent, secure, immutable and distributed database called blockchain. Blockchains can be used to record and transfer any digital asset not just currency. This course will introduce students to the workings and applications of this potentially disruptive technology. Its potential impact on financial services, government, banking, contracting and identity management will be discussed.

Prerequisite: basics of centralized and distributed database and network technologies.

Learning Outcomes:
Students will be able to achieve the following learning objectives at the completion of the course.
1. They will be able to discover blockchain technology.
2. They will be able to learn and explain why we need blockchain. What is the real world problem(s) that blockchain is trying to solve,Understand and describe how blockchain works,Explain the underlying technology of transactions, blocks, proof-of-work, and consensus building, How does blockchain exist in the public domain (decentralized, distributed) yet maintain transparency, privacy, anonymity, security, immutability, history.
3. They will be able to understand that How is blockchain simulated without any central controlling or trusted agency and How bitcoin cryptocurrency works.
4. They will be able to understand Why people value a 'digital' currency, how it can be protected against scam, fraud, hacking and devaluation.
5. They will be able to design and implement new ways of using blockchain for applications other than cryptocurrency and explore platforms such as Ethereum to build applications.
6. All these concepts are important to build their career as Blockchain generalist, blockchain developers and Blockchain contract developer.

Teaching and Evaluation Scheme: Students are evaluated on the basis of continuous evaluation system both in theory and practical classes based on various parameters like term work, class participation, practical and theory assignments, presentation, class test, Regular Attendance, etc.

Sub Total Credit	Teaching scheme		Examination scheme				
	(per week)		MID	CEC	External		Total
	Th	Pr	Th	Th	Th.	Pr.	Marks
4	3	2	25	25	50	50	150

Course Contents:

UNIT1: Discover Blockchain Technology [20%]
Introduction: History of centralized services, trusted third party for transactions, Making a case for a trustless system, Understand the differences between centralised, decentralised and distributed peer to peer networks, Why blockchain, Decentralized transactions, No permission for transactions needed, Types of Blockchain (Permission Blockchain vs. Permissionless Blockchain), History of Bitcons: How and when blockchain/bitcoin started, Milestones on the development of bitcoin, The problem area and promise of bitcoin, Relation to bitcoin, Requirements for blockchain in a business environment, Requirements deep dive, Sharing economy, Internet of Value.

UNIT2: Fundamental concepts of Blockchain [20%]
Overview of blockchain technology: What is blockchain, Transactions, Blocks, Hashes, Consensus, Verify and confirm blocks, Hashes: Hash cryptography, Encryption vs hashing, Transactions:Recording transactions, Digital signature, Verifying and confirming transactions, Blocks and blockchain: Hash pointers, Blocks, Consensus building: Distributed consensus, Byzantine generals problem, Consensus mechanisms: POW, POS, POB, POA, POET, etc., Blockchain Architecture, Markle Root Tree, blockchain and future world of Web 3.0.

UNIT 3: Mining and simulating blockchain [20%]
Mining and simulating blockchain: Game theory behind competitive mining, Race to beat the others (including hackers), Incentives – mining and transaction fees, CPU considerations, Energy expended in mining, Profitability, Mining pools, Blockchain for Bigdata

UNIT 4 : Bitcoins, Security and Safeguard [20%]
Bitcoin: Bitcoin creation and economy, Bitcoin exchanges, Bitcoin limited supply and deflation? Famous hacks, Wallets, Security and safeguards: Protecting blockchain from attackers, Forks – soft and hard, Blockchain Security : Key Management in Bitcoin, Case Studies.

UNIT 5: Platforms and Applications [20%]
Introduction to Blockchain platform: Ethereum, Hyperledger, IOTA, EOS, Multichain, Bigchain, CORDA, Openchain, SOLIDITY, Design a new blockchain, Potential for disruption, How to incentivize blockchain, Design a Distributed Application (DAPP), Blockchain applications: Government, Identity management, Auto executing contracts, Three signature escrow, Triple entry accounting, Elections and voting?, Property records, titles, Micropayments, Notary, Sidechains, Blockchain Smart Contracts, Challenges and Research Issues in Blockchain.

Text Books:
1. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Arvind Narayana.
2. Blockchain Basics 2019: The New Updated Inves…(Paperback), by Bradley Lakeman

Reference Books:
1. Blockchain: Step-By- Step Guide to Understand by Paul Laurence
2. Introducing Ethereum and Solidity Foundations of Cryptocurrency and Blockchain Programming for Beginners by Chris Dannen , Apress
3. Hands-On Blockchain for Python Developers: Gain blockchain programming skills to build decentralized applications using Python Paperback
4. Building Blockchain Projects (English, Paperback, Prusty Narayan), Packt
5. Blockchain: The comprehensive beginner?s guid, (Paperback),by frank walrtin
6. Ultimate Blockchain Technology, Mega Edition – Six Books – Best Deal For Beginners in

Blockchain, Blockchain Applications, Cryptocurrency, Bitcoin, Mining and Investing by Lee Sebastian
7. Blockchain And Decentralized Systems(Paperback) by Pavel Kravchenko, Bohdan Skriabin
8. Masters of Blockchain, Digital Assets & the N…(Paperback), by Andrew Romans, Tim Draper

Web References:
1. https://bitcoin.org/bitcoin.pdf
2. http://scet.berkeley.edu/wp-content/uploads/BlockchainPaper.pdf
3. https://www.evry.com/globalassets/insight/bank2020/bank-2020---blockchain-powering-the-internet-of-value---whitepaper.pdf
4. https://media.consensys.net/programmable-blockchains-in-context-ethereum-s-future-cd8451eb421e#.z4788f3kx
5. https://github.com/anders94/blockchain-demo
6. http://blockchain.mit.edu/how-blockchain-works
7. https://anders.com/blockchain/
8. http://learnmeabitcoin.com/

Live Map or Reachable Nodes

9. https://bitnodes.earn.com/nodes/live-map/

Realtime Bitcoin Globe

10. https://blocks.wizb.it/

Unconfirmed Transactions Visualization

11. http://dailyblockchain.github.io/

Note: Practical can be performed using Open Source Ethereum /Truffle/IBM platform/Solidity/ etc.

Tentative List of Praticals :
1. Explore various popular blockchain applications. Create a list of those applications and the industries/businesses they are impacting
2. Explore the bitcoin blockchain on blockchain.info
3. Use an online service to generate hashes for content
4. Build a transaction and then hash it. Generate public and private keys. Digitally sign a transaction
5. Explore the bitcoin blockchain on blockchain.info for block generation. Explore how long it takes a block to be confirmed.
6. Use an online service to illustrate how consensus is built in a distributed system with no central authority.
7. What is the computing power needed to mine and generate bitcoin? Explore if miner pools are dominating bitcoin mining. Compare incentives from mining activity vs transaction fees.
8. Install a bitcoin wallet. Generate and secure your private key.
9. Send a small transaction amount (to be monetized by instructor) to another user. Track the transaction through blockchain. Verify the confirmation and commitment of the transaction to the bitcoin blockchain.
10. Pick three industries. Research the application of blockchain in those industries. Describe how blockchain could be successful in those industries.
11. Set up the Hyperledger Composer Playground
12. Transfer assets in a blockchain network
13. Explore editor views archive data

14. Create Decentralised application such as Elections.(Using Truffle framework, metamask, ganache)
15. Writing script to create block, perform transaction and validate and verify (mining) using any programming language such as **python, node js, javascript, java.**
16. Implementing smart contract using solidity on **Remix** (https://remix.ethereum.org/#optimize=false&version=soljson-v0.5.1+commit.c8a2cb62.js). It is online IDE that is use to execute and test smart contract.
17. Installing and configure **Ganache** which is in memory local platform for blockchain (https://truffleframework.com/ganache). Install and configure **Metamask** which is available in different extension with browser. Install chrome extension of metamast. Import account from Ganache into metamask and perform transaction and observe block.