

Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NCSD516	Principles of Blockchain Technology	3	0	0	3

#### Course Objective

The objective of the course is to present an understanding of Blockchain Technology, Cryptocurrency, the research gap, and its applications.

#### Learning Outcomes

Upon successful completion of this course, students will:

- Have an insight into the structure of Blockchain Technology and its importance.
- Know how to build cryptocurrency applications based on Blockchain Technology.
- Know how to explore the possible realization of Blockchain technology for applications other than cryptocurrency.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Introduction- Concepts of cryptocurrency and Blockchain, Consensus Algorithms- Security of Blockchain, Blockchain Programs and Network, Concept of Blockchain parameters-Header, Miners, Difficulty, Nonce, Stakes, Forking, Double-Spending Problem;	3	#Basic overview and understanding about the Cryptocurrency and Blockchain Technology.
2.	Preliminaries: Security Services and Mechanisms, Public Key Cryptosystem, ECC, Cryptographic Hash Functions, Digital Signatures, PKI, Merkle Tree	7	#To present the fundamental cryptographic concepts that are essential for Blockchain technology. #To learn about Merkle Data structures, that is commonly used in storing large amounts of data in Blockchain
3.	Introduction to Cryptocurrency, Bitcoin Cryptocurrency: Wallet, Transactions, Mining, Consensus Mechanisms and Validation: Poof of Work (PoW), Bitcoin Security issues, Bitcoin Script, Alternative Coins: Namecoin, Litecoin, Primecoin, Zcash	8	#Basic understanding of Blockchain technology through Bitcoin application.
4.	Ethereum blockchain, Ethereum Virtual Machine, Proof of Stake (PoS), Privacy, Security issues in Blockchain: Anonymity, Sybil Attacks, Selfish Mining, Privacy-enhancing technologies: zero-knowledge proofs, ring signatures, etc.	7	#Basic understanding of Ethereum based Blockchain technology. # To learn some Privacy and Security issues in Blockchain
5.	Types of Blockchain Consensus algorithms, Study and comparison of different consensus algorithms: Delegated Proof of Stake (DPoS), Practical Byzantine Fault Tolerance (PBFT), Algorand, Ouroboros	6	#To understand different consensus algorithms in details.
6.	Smart Contract Fundamentals: Introduction to Smart Contracts, Framework of smart contract, Life cycle of smart contract, Challenges of Smart Contract, Examples of smart contract use cases	5	# To get an overview on Smart Contracts
7.	Case Studies as Blockchain technology based Applications (like in e-Governance, e-Commerce, Database Applications where third party is involved)	6	#Understanding the possible research scope based on studies of some recent research papers.
	Total	42	

#### Text Books:

1. A. Narayanan, J. Bonneau, E. Felten, A. Miller, and S Goldfeder, "Bitcoin and Cryptocurrency Technologies", Princeton University Press, 2016
2. Xiwei Xu, I. Weber, M. Staples, "Architecture for Blockchain Applications", Springer, 2018.

#### Reference Books

1. M. Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015
2. Lecture Note of S.Vijayakumaran (IIT Bombay), "An Introduction to Bitcoin".
3. Lecture Note of S. Shukla (IIT Kanpur), "Introduction to Blockchain Technology and Applications".