राष्ट्रीय प्रौद्योगिकी संस्थान पटना / NATIONAL INSTITUE OF TECHNOLOGY PATNA
संगणक विज्ञान एंव अभियांत्रिकी विभाग / DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
अशोक राजपथ, पटना-८००००५, बिहार / ASHOK RAJPATH, PATNA-800005, BIHAR
Phone No.: 0612-2372715, 2370419, 2370843, 2371929 Ext- 200, 202 Fax-0612-2670631 Website: www.nitp.ac.in

No:- Date:

MC47XX21: Blockchain Technology L-T-P-Cr: 3-0-0-3

Pre-requisites: Expertise in Programming, Basic Knowledge of Computer Security, Cryptography, Networking, Computer Systems Security

Objectives/Overview:

- To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers.
- To understand the structure of a blockchain and why/when it is better than a simple distributed database
- To make students understand the technological underpinnings of blockchain operations as distributed data structures and decision making systems.
- To understand a "smart" contract and its legal implications.
- To provide a critical evaluation of existing "smart contract" capabilities and platforms, and examine their future directions, opportunities, risks and challenges.

Course Outcomes:

Upon completion of this course, students will be:

S.NO	Outcome	Level of Attainment
CO-1	Able to design smart contracts and decentralized applications.	Usage
CO-2	Able to understand Distributed Ledger Technologies and apply this concept in real world.	Usage
CO-3	Able to design innovative application models using the the Blockchain technology.	Usage
CO-4	Able to understand core concepts of Blockchain technology that are commonly used across multiple industries to solve large scale problems.	Familiarity

Course Outcomes–Cognitive Levels–Program Outcomes Matrix –
[H: High relation (3); M: Moderate relation (2); L: Low relation (1)]

Course Outcomes	Program Outcomes											
	PO-1 (Engineering knowledge)	PO-2 (Problem analysis)	PO-3 (Design/ development of solutions)	PO-4 (Conduct investigations of complex problems)	PO-5 (Modern tool usage)	PO-6 (The engineer and society)	PO-7 (Environment and sustainability)	PO-8 (Ethics)	PO-9 (Individual and team work)	PO-10 (Communication)	PO-11 (Project management and finance)	PO-12 (Life-long learning)
CO-1	H	H	H	M	H	M	H	H	L	H	H	M
CO-2	H	M	H	M	H	H	H	M	L	M	H	H
CO-3	H	M	H	L	H	H	H	M	M	M	H	H

CO-4	H	H	L	H	H	H	H	M	M	H	H	H

UNIT I: **Lectures: 4**

Introduction to Blockchain, Structure of a Block, Types of Blockchain, Public Ledgers, Blockchain as public ledgers, Cryptocurrency as application of blockchain technology

UNIT II: **Lectures: 6**

Basic Cryptographic primitives used in Blockchain – Secure, Collision-resistant hash functions, Digital signature, Public key cryptosystems, Zero-knowledge proof systems Cryptographic Hash Function, SHA-256, Properties of a hash function, Hash pointer and Merkle tree.

UNIT III: **Lectures: 6**

Consensus, Distributed consensus in open environments, Consensus in a Bitcoin network
Types of consensus algorithm: Proof of Work (PoW), Proof of Stake (PoS), Delegated Proof of Stake (DPoS), Ripple, Proof of Burn

UNIT IV: **Lectures: 5**

Introduction to Bitcoin, History of Bitcoin, Bitcoin Transactions, Bitcoin Mining, Bitcoin Address.

UNIT V: **Lectures: 8**

Introduction to Ethereum - Ethereum Virtual Machine (EVM), Wallets for Ethereum, Differences between Ethereum and Bitcoin, Block format, Mining algorithm, Solidity using Remix IDE, Smart Contracts, Some attacks on smart contracts. Implementations of Blockchain using Python.

UNIT VI: **Lectures: 8**

Blockchain Technology: Hyper ledger Fabric: System architecture, ledger format, chaincode execution, transaction flow and ordering, private channels, membership service providers, Fabric Peer and Certificate Authority,Case studies of applications

UNIT VII: **Lectures: 5**

Case studies and projects based on Blockchain Technology.

Text / Reference Books:

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos, O'Reilly publisher
2. Blockchain Blueprint for a New Economy,by Melanie Swan, O'Reilly
3. Narayanan, Arvind, et al. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton University Press, 2016.
4. Antonopoulos, Andreas M. Mastering Bitcoin: Programming the Open Blockchain. O'Reilly Media, Inc., 2017
5. Antonopoulos, Andreas M. and Wood, Gavin. Mastering Ethereum. O'Reilly Media, Inc., 2018. (Free draft available at https://github.com/ethereumbook/ethereumbook)
6. Ethereum project documentation. Online: http://www.ethdocs.org/en/latest/
7. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
8. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
9. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric