BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
AUGS/ AGSR Division

SECOND SEMESTER, 2020-2021
Course Handout

14/01/2021

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course Number	**: BITS F452**
Course Title	**: Blockchain Technology**
Instructor-in-charge	**: Dr. Amit Dua (amit.dua@pilani.bits-pilani.ac.in)**
Instructor(s)	**: Dr. Ashutosh Bhatia (ashutosh.bhatia@pilani.bits-pilani.ac.in)**

1. **Scope and Objective of the course**

The recent developments in the Blockchain have led to its pervasive influence, especially in Cryptocurrencies, Insurance, Energy and Trade, Finance, Healthcare, Supply Chain, and any other critical fields. With the widespread acceptance of cryptocurrencies and Blockchain as its core technology, both academia, and industry, are seeing enormous opportunities. Blockchain technology can be used to develop solutions involving non-economic transactions. Some of them include IoT, distributed cloud storage, supply chain management, medicine, ownership, and royalty distribution, and decentralized autonomous organizations. This course provides a comprehensive understating of essential concepts involved in blockchain technology and its applications. The course provides fundamental understandings of Blockchain architecture, cryptocurrencies (especially Bitcoin), Smart contracts, Consensus algorithms, Permissionless and Permissioned blockchains, and the development of Decentralized Application using Ethereum and Hyperledger. The registered students will become confident in understanding the existing applications and develop complete end-to-end solutions to the practical problems using the Blockchain concepts. The case studies discussions and projects enable students to assimilate the concepts better. Finally, the course will also shed some light on the current advancements in the Blockchain and few topics beyond blockchains such as DAG-based distributed ledgers.

The objectives of the course are

1. To provide acomprehensive understating of foundational and other essential concepts involved in blockchain technology.
2. To introduce the concept and development process of decentralized applications pertaining to number of verticals such as finance, supply chain, governance etc. through both theory and practical.
3. To introduce the current advancements in the Blockchain and few topics beyond blockchains such as DAG-based distributed ledgers.

2. **Text Book**

TB: Imran Bashir, **Mastering Blockchain: Distributedledger technology, decentralization, and smart contracts explained**, 2nd Edition, Packt Publishing, 2018

3. **Reference Book(s)**

R1: Narayanan, Arvind, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. **Bitcoin and cryptocurrency technologies: a comprehensive introduction**. Princeton University Press, 2016

4. **Lecture Plan**

Module	Lecture session	Learning Outcome	Topics	Reference
1	1-5	Overview of Blockchain Technology	Defining Blockchain and Distributed Ledger, Blockchain Properties Decentralized, Transparent, Immutable and secure. Blockchain Applications. Types of Blockchain: Public, private, and consortium based blockchain, When to use, and when not to use Blockchain, History of Blockchain.	TB: Ch 1 R1: Ch 0,1
2	6-8	Introduction to computing models and P2P networking	Centralized, Decentralized and Distributed Systems, Decentralization vs distributed, P2P systems, propertied of P2P systems, P2P communication architecture. P2P network applications: File sharing, P2P network for blockchain	TB: Ch 1
3	9-12	Foundational Concepts Blockchain Data Structure	Cryptographic Hash Functions, Digital Signatures, Public Keys as Identities, Hash Pointers and Hash chain and Merkel tree, Consensus mechanisms	TB: Ch3 R1: Ch1
4	13-18	Blockchain Characteristics	Decentralized Identity management, Transactions, incentivising and mining. Distributed Consensus (PoW), Cryptocurrency as the first blockchain application. Mechanics of Bitcoin, Bitcoin Scripts, Storing and Using Bitcoins, Mining in Bitcoin.	TB: Ch4 R1: Ch 2,3,4,5,6
5	19-21	Other Consensus Mechanisms	Proof of storage, proof of stake**,** proof of deposit, proof of burn, proof of activity. algorithms for adjusting difficulty and retargeting. Limitations of Bitcoin, alternative cryptocurrencies.	TB: Ch5 R1: Ch 8
6	22-27	Smart Contracts and Ethereum	History, Purpose and types of smart contracts, Introduction to Ethereum, bitcoin vs Ethereum stack. P2P network in Ethereum, consensus in Ethereum, scripts in Ethereum, Smart contracts (Ethereum Virtual Machine). Developing and executing smart contracts in Ethereum. State and data structure in Ethereum.	TB: Ch 6, 7,8 R1: Ch 11
7	28-33	Private and Consortium based Blockchain: Hyperledger	Need for the consortium. Hyperledger stack, Multichainblockchain. Innovation in Hyperledger, smart contracts, and distributed applications in hyperledger.	TB: Ch 9
8	34-40	Case studies/ Enabling Technologies and applications	Application of blockchain in privacy and security, IoT and smart cities, Business and Industry, Data management, e-Governance	TB: Ch 10,11 R1: Ch11

5. Evaluation components

Component	Duration	Weightage(%)	Date & Time	Mode
Midsem	90 Mins.	30	<TEST_1>	Closed Book
Project		20	-	OB
Quiz	30 minutes	10	-	OB
Seminar	20 minutes	5	-	OB

Comprehensive Exam	3 Hrs.	35	<TEST_C>	Partly Open

6. **Make-up Policy**
   Make-up will be granted strictly on **prior permission** and for genuine reasons only.

7. **Chamber Consultation Hours**:
   Amit Dua TUESDAY 4-5 PM
   Dr. Ashutosh Bhatia MONDAY 5 – 6 PM

8. **Notice**: All the notices will be put up on NALANDA only.

Instructor in Charge
BITS F452