

**CHAROTAR UNIVERSITY OF SCIENCE AND
TECHNOLOGY FACULTY OF TECHNOLOGY &
ENGINEERING**

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

OCCSE3003: BLOCKCHAIN & ITS APPLICATIONS

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/Week	3	2	0	5	4
Marks	100	50	0	150	

Pre-requisite courses:

1. Computer Network
2. Cryptography and Network Security
3. Operating Systems

Description: This course Blockchain Technology & Applications is offered from SWAYAM as OCCSE3003 – Blockchain & its Applications.

URL:

https://onlinecourses.nptel.ac.in/noc25_cs08/preview

Outline of the Course:

Sr. No.	Title of the unit	Number of hours
1.	Introduction to Blockchain Technology & Cryptographic Basics	7
2.	Cryptographic Methods & Blockchain Evolution	10
3.	Blockchain Fundamentals & Consensus Models	10
4.	Smart Contracts and Decentralized Identity Management	10
5.	Advanced Topics & Blockchain Applications	8

Total hours (Theory): 45

Total hours (Lab): 30

Total hours: 75

A. Detailed Syllabus:

Unit No.	Unit/Topics	Hours	Weightage (%)
1	Introduction to Blockchain Technology & Cryptographic Basics	7	16%
Week 1,2	Introduction to blockchain & Bit coin, Use-cases of Blockchain, Decentralization with Blockchain, Properties of Blockchain, Cryptographic primitives useful for Blockchain, Hash Functions, SHA-256, Types of Hashing, Hash Chain, Construction of Chain of Blocks, Basic Concepts of Cryptography, Public Key Cryptography, Encryption & Decryption using Public Key Cryptography, Digital Signature, RSA Encryption & Decryption, Distributed Systems, Cryptocurrency, open Consensus and Bitcoin		
2	Cryptographic Methods & Blockchain Evolution	10	22%
Week 3,4	Bitcoin Mining, Smart Contract & Automated code execution, Permissioned Blockchain, Block in Blockchain, Block header, Block generation cost, Transaction in a block, understanding bitcoin script, Block Mining & Propagation, Forking & Propagation of Long chain, Double Spending Problem, Bitcoin Exchange, Permission-less model & Open Consensus, Nakamoto Consensus(Proof-of-Work), Limitation of Proof-of-Work		
3	Blockchain Fundamentals & Consensus Models	10	22%
Week 5,6,7	Proof of Stack, Proof of Burn, Proof of Elapsed Time, Introduction to Ethereum, Obtaining Ethereum for testnets, Ethereum Applications- DApps, Ethereum Smart Contracts, Ethereum Virtual Machines, Solidity Language, Consensus for Permissioned Model, State machine replication as Distributed consensus, PAXOS, Byzantine Faults, Byzantine Agreement Protocols, Safety & Liveness of Practical Byzantine Fault Tolerance, Enterprise Blockchain, Basics of Hyperledger Fabric		
4	Smart Contracts and Decentralized Identity Management	10	22%
Week	Hyperledger Fabric Chaincode, Hyperledger Fabric		

8,9,10	Applications, Implementing Hyperledger Fabric		
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	using DApps, Scalability of Blockchain, Basic Concept of Identity, Centralized Identity Management, Decentralized Identity Management, What is single sign on, What is DID, DID Work Flow, Working Principles of Verifiable Credentials(VCs), VC issuer, holder & Verifier, Use of Decentralized registry in VC Management, VC Trust Model, Combining DID & VC, Blockchain Interoperability, Hyperledger Indy		
5.	Advanced Topics & Blockchain Applications	8	18%
Week 11,12	Hyperledger Aries, Blockchain Security, Risks in Blockchain, Common Risks and Specific Risks, Selfish Mining Attack, Eclipse Attack, Front-running Attack, Blockchain Uses-cases: Land Registry Record, Financial services, Public Sector Use-cases, Blockchain for decentralized marketplace, Education		

B. Course Outcome:

After completion of the course, Students will be able to

CO1	Understand foundational blockchain concepts and basic cryptography behind blockchain technology.
CO2	Understand cryptographic techniques and the historical development of blockchain technology.
CO3	Identify blockchain elements and evaluate consensus algorithms.
CO4	Develop smart contracts and understand decentralized identity management.
CO5	Explore blockchain interoperability and real world applications.

C. Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	1	-	-	2	1	-	-	-	2	-
CO2	-	2	-	-	-	2	1	1	1	-	2	-	1	2
CO3	1	3	2	1	-	2	-	-	2	-	1	2	3	-
CO4	1	1	2	2	3	2	2	2	2	-	3	2	3	1
CO5	1	3	3	2	3	2	2	2	3	2	3	2	3	2

Enter correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial

(High) If there is no correlation, put “-”.

D. Recommended Study Material:

❖ Text/ Reference Books:

1. Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Imran Bashir, Packt Publishing, 2020, ISBN: 9781839213199, book website: <https://www.packtpub.com/product/mastering-blockchain-third-edition/9781839213199>
2. Hyperledger Tutorials - <https://www.hyperledger.org/use/tutorials>
3. Andreas M. Antonopoulos, Mastering Bitcoin, O'Reilly, Second Edition
4. Don Tapscott, Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World, Hardcover, May 2016.