

**Faculty of Science and Technology
Savitribai Phule Pune University
Maharashtra, India**



**Honors* in major Disciplines Board of Studies
(Electronics & Telecommunication)
(2019 Course)
(with effect from A.Y. 2021-22)**

Savitribai Phule Pune University
Board of Studies (Electronics & Telecommunication)
 With effect from 2021-22

Honors* in Block Chain Technology

Course Code	Course Title	Teaching Scheme Hours / Week			Examination Scheme and Marks						Credit Scheme		
		Theory	Tutorial	Practical	Mid-Semester	End-Semester	Term work	Practical	Presentation	Total Marks	Theory / Tutorial	Practical	Total Credit
304181 HBCT	Introduction to Block chain	04	--	--	30	70	--	--	--	100	04	--	04
304182 HBCT	Block Chain Laboratory	--	--	02	--	--	50	--	--	50	--	01	01
	Total	04	-	02	100		50	-	-	150	04	01	05
Total Credits = 05													
304183 HBCT	Decentralize & Blockchain Technologies	04	--	--	30	70	--	--	--	100	04	--	04
	Total	04	-	-	100		-	-	-	100	04	-	04
Total Credits = 04													
404181 HBCT	Smart Contracts & Cryptocurrency	04	--	--	30	70	--	--	--	100	04	--	04
404182 HBCT	Smart Contracts & Cryptocurrency Laboratory	--	--	02	--	--	50	--	--	50	--	01	01
	Total	04	-	02	100		50	-	-	150	04	01	05
Total Credits = 05													
404183 HBCT	Block Chain Solutions	04	-	--	30	70	--	--	--	100	04	--	04
404184 HBCT	Seminar	--	02	--	--	--	-	--	50	50	02	--	02
	Total	04	-	02	100		-	--	50	150	06	-	06
Total Credits = 06													
Total Credit for Semester V+VI+VII+VIII = 20													

* To be offered as Honors for Major Disciplines as-

1. Electronics Engineering
2. Electronics and Telecommunication Engineering
3. Electronics & Computer Engineering
4. Computer Engineering
5. Information Technology

For any other Major Disciplines which is not mentioned above, it may be offered as Minor Degree.

Savitribai Phule Pune University

Board of Studies (Electronics & Telecommunication)

Honors in Block Chain Technology

304181 HBCT: Introduction to Blockchain

Teaching Scheme:	Credit	Examination Scheme:
Theory: 04 Hrs. / Week	04	In-Sem (Theory): 30 Marks End Sem (Theory): 70 Marks

Course Contents

Unit I	Introduction to Block Chain Technology	(08 Hrs)
Introduction – basic ideas behind blockchain, how it is changing the landscape of digitalization, introduction to cryptographic concepts, Hashing, public key cryptosystems, private vs public blockchain and use cases, Hash Puzzles		
Unit II	Block Chain Fundamentals	(08 Hrs)
Basic architecture of Block Chain, different terminologies associated Characteristics of Block chain, Types of networks, Introducing Smart contract concept in Blockchain.		
Unit III	Components of Block Chain	(08 Hrs)
Core components of Block Chain, Types of Blockchains; Blockchain Protocol, Permission & Permission less Blockchains, Applications of Block Chain Technology, Few case studies on Block Chain Technology		
Unit IV	Digital Ledger	(06Hrs)
Short History of Money and Trust, Bitcoin Mechanics, Other Applications of Blockchains, Introduction to Hyperledger, Hyperledger Fabric and its architecture, Hyperledger Composer		
Unit V	Emerging Trends in Block Chain	(08 Hrs)
Cloud-based blockchain, Multichain, Geth , Stellar , Ripple, R3 Corda, Blockchain API, Blockchain Sandboxes		
Unit VI	Block Chain Use Cases	(10Hrs)
Supply Chain Management, Finance, Health Care, Remittance, Land Records, Voting and election, Loyalty Programs, Go Green (Renewable Energy)		

Learning Resources

Text Books:

1. Artemis Caro, “Blockchain: The Beginners Guide to Understanding the Technology Behind Bitcoin & Cryptocurrency”.
2. Scott Marks, “Blockchain for Beginners: Guide to Understanding the Foundation and Basics of the Revolutionary Blockchain Technology”, CreateSpace Independent Publishing Platform

Reference Books:

1. Mark Watney, “Blockchain for Beginners”.
2. Alwyn Bishop, “Blockchain Technology Explained”.

MOOC / NPTEL Courses:

1. NPTEL Course “**Introduction to Block Chain Technology & Applications**”
<https://nptel.ac.in/courses/106/104/106104220/>
2. NPTEL Course on “**Blockchain Architecture & Use Cases**”
<https://nptel.ac.in/courses/106/105/106105184/>

Savitribai Phule Pune University

Board of Studies (Electronics & Telecommunication)

Honors in Block Chain Technology

304182 HBCT: Block Chain Laboratory

Teaching Scheme:	Credit	Examination Scheme:
Practical: 02 Hrs. / Week	01	Practical: 50 Marks

Companion Course, if any: **Introduction to Blockchain**

Guidelines for Laboratory Conduction

During each lab experiment the following activities will be carried out:

- The instructor will explain the aims & objectives of the assignments.
- The instructor will explain the topics required to carry out the experiment.
- The students will do the hands on as per the Lab manual & Web resources provided.

The students will show the results to the instructor.

Guidelines for Student's Lab Journal

The student's Lab Journal can be assignments submitted in the form a soft copy/hard copy. In case of soft copy submission, the print out of only first page can be kept in the Journal. It should include following as applicable:

Assignment No, Title of Assignment, Date of Performance, Date of Submission, Aims & Objectives, Theory, Description of data used, Results, Conclusion.

Guidelines for Lab/TW Assessment

The oral examination will be based on the work carried out by the student in the Lab course. Suitable rubrics can be used by the internal & external examiner for assessment.

List of Assignments

1.	Naive Blockchain construction
2.	Memory Hard algorithm - Hashcash implementation
3.	Direct Acyclic Graph
4.	Smart Contract Construction
5.	Toy application using Blockchain
6.	Mining puzzles

Savitribai Phule Pune University

Board of Studies (Electronics & Telecommunication)

Honors in Block Chain Technology

304183 HBCT: Decentralize & Blockchain Technologies

Teaching Scheme:	Credit	Examination Scheme:
Theory: 04 Hrs. / Week	04	In-Sem (Theory): 30 Marks End Sem (Theory): 70 Marks

Course Contents

Unit I	Decentralized Systems	(08 Hrs)
Introduction to Decentralized System, Disintermediation, Contest Driven, Framework and Ecosystem for Decentralized System.		
Unit II	Decentralized Applications	(06 Hrs)
Introduction to Decentralized Applications, Blockchain Mining, Whisper, Swarm, Forks.		
Unit III	Consensus and Fault Tolerances	(08 Hrs)
Consensus Approach, Consensus Elements, Consensus Algorithms, Proof of Work, Byzantine General problem, Proof of Stake, Proof of Elapsed Time, Proof of Activity, Proof of Burn.		
Unit IV	Ethereum Blockchain Components	(08 Hrs)
Introduction to Ethereum Development Tools, Ethereum Clients, Ethereum Languages, Ethereum Wallets, Ethereum Accounts, Ethereum Keypairs, Ethereum Platform.		
Unit V	Blockchain Technologies	(06 Hrs)
Selection of Blockchain technology, Determining the business needs, Defining the goal and Choosing a Solution		
Unit VI	Block Chain Applications	(06 Hrs)
Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain		

Learning Resources

Text Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press.
2. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies"

Reference Books:

1. Satoshi Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System".
2. Dr. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger", Yellow paper 2014.
3. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, "A survey of attacks on Ethereum smart contracts"

MOOC / NPTEL Courses:

1. NPTEL Course "**Introduction to Block Chain Technology & Applications**"

<https://nptel.ac.in/courses/106/104/106104220/>

2. NPTEL Course on "**Blockchain Architecture & Use Cases**"

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Board of Studies (Electronics & Telecommunication)

Honors in Block Chain Technology

404181 HBCT: Smart Contracts & Cryptocurrencies

Teaching Scheme:	Credit	Examination Scheme:
Theory: 04 Hrs. / Week	04	In-Sem (Theory): 30 Marks End Sem (Theory): 70 Marks

Course Contents

Unit I	Smart Contracts	(08 Hrs)
Introduction to Smart Contracts, Structure of Smart Contract, Smart Contract Interaction, Contracts Patterns and Smart Contracts Examples.		
Unit II	Hyperledgers	(08 Hrs)
Hyperledger Fabric, Sawtooth, Indy, Hyperledger tools Caliper and Hyperledger library Ursa, Blockchain as-a-service deployment model of Hyperledger Cello.		
Unit III	Cryptocurrency	(08 Hrs)
History Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.		
Unit IV	Cryptocurrency Regulation	(08 Hrs)
Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain for cryptocurrencies.		
Unit V	Bitcoins	(08 Hrs)
Introduction to Bitcoins, Bitcoin : Digital Signature, Digital Keys, Private Keys, Public Keys, Bitcoins Addresses, Bitcoins Transactions, Bitcoins Network, Bitcoins Wallets, Bitcoins Payments, Bitcoins Clients and APIs, Bitcoins Limitation		
Unit VI	Case studies of Block Chain in Cognitive applications	(04 Hrs)
IBM Block Chain, Blockchain in Health care Innovation, AI Marketplaces, Investment Management Platforms, Future of AI and Block Chain		

Learning Resources

Text Book:

1. J.H. Huiwitz, M.Kaufman, A.Bowles, “ Cognitive Computing & Big Data Analytics”,Wiley Publication

Reference Books / Research Papers:

2. A. Reyana, C.Martin, J.Chen, E.Soler, M.Diaz, “On blockchain and its integration with IoT challenges & Opportunities” Paper in Future Generation Computer Systems, Vol. 88, Nov. 2018, pp. 173-190.
3. H.F.Atlam, Muhammad A.A.,A.G. Alzharani, G. Wills, “A review of Blockchain in Internet of Things and AI”,paper in Big Data and Cognitive Computing, Vol.4, Issue 28, Oct. 2020

MOOC / NPTEL Courses:

1. NPTEL Course “**Machine Learning**”
<https://nptel.ac.in/courses/106/106/106106202/>

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Honors in Block Chain Technology

404182 HBCT: Smart Contracts & Cryptocurrency Laboratory

Teaching Scheme:	Credit	Examination Scheme:
Practical: 02 Hrs. / Week	01	Practical: 50 Marks

Companion Course, if any: **Smart Contracts & Cryptocurrency**

Guidelines for Laboratory Conduction

During each lab experiment the following activities will be carried out:

- The instructor will explain the aims & objectives of the assignments.
- The instructor will explain the topics required to carry out the experiment.
- The students will do the hands on as per the Lab manual & Web resources provided.
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The student's Lab Journal can be assignments submitted in the form a soft copy/hard copy. In case of soft copy submission, the print out of only first page can be kept in the Journal. It should include following as applicable:

Assignment No, Title of Assignment, Date of Performance, Date of Submission, Aims & Objectives, Theory, Description of data used, Results, Conclusion.

Guidelines for Lab /TW Assessment

The oral examination will be based on the work carried out by the student in the Lab course. Suitable rubrics can be used by the internal & external examiner for assessment.

List of Assignments

1.	Study assignment on blockchain-based applications/projects.
2.	Install and Getting Started with the Bitcoin core client. Write a program to get a Bitcoin and create transaction.
3.	Write a program to implement application on bitcoin
4.	Setup the Ethereum development environment. Generate addresses and create transaction.
5.	Write a program to implement application on Ethereum.
6.	Write a program to create smart contract
7.	Case studies on Cognitive computing

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404183 HBCT: Blockchain Solutions

Teaching Scheme:	Credit	Examination Scheme:
Theory: 04 Hrs. / Week	04	In-Sem (Theory): 30 Marks End Sem (Theory): 70 Marks

Course Contents

Unit I	Blockchain Vertical Solutions	(08 Hrs)
Blockchain in BFSI, Blockchain in Industrial and Manufacturing, Blockchain in Assets and Inventory Registry, Blockchain in Utilities, Blockchain in Logistics, Blockchain in Healthcare.		
Unit II	Blockchain Allied Technology Platforms	(08 Hrs)
Applications of blockchain in cyber security, integrity of information, E-Governance and other contract enforcement mechanisms.		
Unit III	Construction of Blockchain	(08 Hrs)
Naive Blockchain construction, Memory Hard algorithm – Hashcash implementation, Direct Acyclic Graph, Go-ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles		
Unit IV	Blockchain Security: Attacks & Defense	(08 Hrs)
Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains: Sybil attacks, selfish mining and 51% attacks; Advent of Algorand, and Sharding based consensus algorithms to prevent the attacks.		
Unit V	Blockchain Applications	(06 Hrs)
Internet of Things-Medical Record Management System-Blockchain in Government and Blockchain Security-Blockchain Use Cases –Finance		
Unit VI	Limitations of Block Chain	(04 Hrs)
Myths v/s. Reality of blockchain technology.		

Learning Resources

Text Books:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press.
2. Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”

Reference Books:

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404184 HBCT: Seminar

Teaching Scheme:	Credit	Examination Scheme:
Tutorial: 02 Hrs. / Week	02	Presentation: 50 Marks

Seminar is a course requirement where in under the guidance of a faculty member a student is expected to do an in depth study on the topic relevant to latest trends in the field of concerned Honors degree selected by him / her and approved by the authority; by doing literature survey, understanding different aspects of the problem and arriving at a status report in that area. While doing a seminar, the student is expected to learn investigation methodologies, study relevant research papers, correlate work of various authors/researchers critically, study concepts, techniques, prevailing results etc., analyze it and present a seminar report. It is mandatory to give a seminar presentation before a panel constituted for the purpose. The grading is done on the basis of the depth of the work done, understanding of the problem, report and presentation by the student concerned.

GUIDELINES FOR THE SEMINAR

A. Guidelines for preparation of Report:

- Report should have at least 30 and at most 50 pages.
- The entire pages of the report should be in A4 size strictly, with 1” top and bottom margin and 1.25” left and right margin.
- The entire report should be typed in Times New Roman with (12 Pt.)
- The title and main headings of the paragraphs are to be in bold.
- Report may be divided into the number of chapters as required, with chapter number assigned on the top left corner and chapter name immediately below it (with single line spacing) using Times New Roman (16 Pt. Bold).
- Every sub heading should be given decimal of whole number of the heading. (e.g1.1).
- The complete text should be justified in the report (no left or right aligning).
- No short forms are to be used in the report besides the specified areas.
- Numbering of each figure and table should be done according to the chapter number.
- Numbering of each page should be done in the footer section at the bottom right corner.
- Each line should be separated by a line spacing of 1.5, and each paragraph by line spacing of 2.

B. List of Contents in the Report:

- The Cover
- Cover page. (Same as The Cover)
- Certificate from Department
- Acknowledgement.
- Abstract.
- Table of content.
- List of figures and tables
- The report.
- References and appendices.

C. Guidelines for Presentation:

- The presentation shall be limited to 15 minutes plus 10 minutes questions and answers. There will be credit for the novelty of the topic, contents of the seminar, the effectiveness of presentation, and the way questions and queries are answered.
- Presentations shall be prepared using presentation software like MS PowerPoint. If necessary, use charts, drawings, etc.
- Write only points on the slides (use telegraphic language instead of long sentences). The slides shall NOT be a copy of the text of one's seminar report. Ideally 6 to 8 lines only shall be there on each slide.
- Equations shall be given in the final form only. Derivations shall be avoided on slides. However, the derivations can be prepared as separate slides with links from the main presentation so that the same can be used if need arises.
- Use colors to make the slides attractive and to highlight the important points. However, remember that the use of too many different colors can make the slides ugly.
- Choose the letter sizes corresponding to the importance of the points. Use bold/italics type or different colors to stress words or sentences of importance.
- Ensure that all the material presented on slides is legible when projected.
- Reading of the written/typed material or from the slides is not acceptable.