Lesson Plan

T.E. (HONOR) (Semester V)

Subject: Bitcoin and Cryptocurrency

Subject code: HBCC501

Teacher-in-charge: Prof. Monali Shetty

Academic Term: July – October 2022

Detailed Syllabus:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	**Prerequisite**	**Introduction to Cryptography:** Hash functions, Public key cryptography, Digital Signature (ECDSA).	**2**	--
I	**Introduction to Block chain**	Structure of a Block, Block Header, Block Identifiers: Block Header Hash and Block Height, The Genesis Block, Linking Blocks in the Block chain, Merkle Trees and Simplified Payment Verification (SPV). **Self-learning Topics:** Block chain Demo.	**6**	CO1
II	**Consensus and Mining**	Decentralized Consensus, Byzantine General's Problem, Independent Verification of Transactions, Mining Nodes, Aggregating Transactions into Blocks, Constructing the Block header, Mining the Block, Successfully Mining the Block, Validating a New Block, Assembling and Selecting Chains of Blocks, Block chain Forks **Self-learning Topics:** Study different consensus algorithms	**12**	CO2
III	**Introduction to Bit coin**	What is Bit coin and the history of Bit coin, Getting the first bit coin, finding the current price of bit coin and sending and receiving bit coin, Bit coin Transactions. **Self-learning Topics:** Study the website coinmarketcap.com/	**4**	CO3
IV	**Concepts of Bit coin**	**Keys and addresses, Wallets and Transactions:** Public Key Cryptography and Crypto currency, Private and Public Keys, Bit coin Addresses, Base58 and Base58Check Encoding, Nondeterministic (Random) Wallets, Deterministic (Seeded) Wallets, HD Wallets (BIP-32/BIP-44), Wallet Best Practices, Using a Bit coin Wallets, Transaction Outputs and Inputs, Transaction Fees, Transaction Scripts and Script Language, Turing Incompleteness, Stateless Verification, Script Construction (Lock + Unlock), Pay-to-Public-Key-Hash (P2PKH), Bitcoin Addresses, Balances, and Other Abstractions **Self-learning Topics:** Visit and use https://bitcoin.org/en/	**13**	CO4

V	**Bit coin Networks**	Peer-to-Peer Network Architecture, Node Types and Roles, Incentive based Engineering The Extended Bitcoin Network, Bitcoin Relay Networks, Network Discovery, Full Nodes, Exchanging "Inventory", Simplified Payment Verification (SPV) Nodes, Bloom Filters, SPV Nodes and Privacy, Encrypted and Authenticated Connections, Transaction Pools **Self-learning Topics:** Study technical papers based on bitcoin security	**7**	CO5
VI	**Blockchain Applications & case studies**	Domain-Specific Applications: FinTech, Internet of Things, Industrial and Manufacturing, Energy, Supply chain & Logistics, Records & Identities, Healthcare Case studies related to cryptocurrencies Concept of Altcoin **Self-learning Topics:** Read Technical papers on blockchain applications	**8**	CO6

Course Objectives:

1. To get acquainted with the concept of Block and Blockchain
2. To learn the concepts of consensus and mining in Blockchain
3. To get familiar with the bitcoin currency and its history.
4. To understand and apply the concepts of keys, wallets and transactions in the Bitcoin Network.
5. To acquire the knowledge of Bitcoin network, nodes and their roles.
6. To analyze the applications and case studies of Blockchain.

Course Outcomes:

Upon completion of this course students will be able to:

CO-PO-PSO Mapping:

HBCC50.1 : Describe the basic concept of Blockchain and its applications.
HBCC501.2 : Associate knowledge of consensus and mining in Blockchain
HBCC501.3 : Summarize the Bitcoin crypto currency at an abstract level.
HBCC501.4 : Apply the concepts of keys, wallets and transactions in the Bitcoin Network.
HBCC501.5 : Interpret the knowledge of Bitcoin network, nodes and their roles.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
HBCC501.1	1													1
HBCC501.2	1													
HBCC501.3	1													
HBCC501.4	1	2			1									
HBCC501.5	2													

Justification of PO to CO mapping

Course Outcome	Competency	Performance Indicator
HBCC501.1	1.3 Demonstrate competence in engineering fundamentals	1.3.1 Apply engineering fundamentals

	1.4 Demonstrate competence in specialized engineering knowledge to the program	1.4.1 Apply theory and principles of Computer Science and engineering to solve an engineering problem
HBCC501.2	1.3 Demonstrate competence in engineering fundamentals	1.3.1 Apply engineering fundamentals
HBCC501.3	1.4 Demonstrate competence in specialized engineering knowledge to the program	1.4.1 Apply theory and principles of Computer Science and engineering to solve an engineering problem
	2.3 Demonstrate an ability to formulate and interpret a model	2.3.1 Able to apply computer engineering principles to formulate modules of a system with required applicability and performance.
HBCC501.4	1.3 Demonstrate competence in engineering fundamentals	1.3.1 Apply engineering fundamentals
	2.4 Demonstrate an ability to execute a solution process and analyze results	2.4.1 Applies engineering mathematics to implement the solution
	5.2 Demonstrate an ability to select and apply discipline-specific tools, techniques and resources	5.2.2 Demonstrate proficiency in using discipline-specific tools
HBCC501.5	1.3 Demonstrate competence in engineering fundamentals	1.3.1 Apply engineering fundamentals
	1.4 Demonstrate competence in specialized engineering knowledge to the program	1.4.1 Apply theory and principles of Computer Science and engineering to solve an engineering problem

Justification of CO to PSO mapping:

HBCC501.1	2.3 Demonstrate an ability to identify tools and measures to protect the assets from cyber-attacks.	2.3.3 Choose appropriate tools and methods to protect the assets from cyber-attacks.

CO Assessment Tools:

Course Outcomes	Unit Tests		Quizzes		Presentation and Blog Activity	End SemExam	Course exit survey
	1	2	1	2			
HBCC50.1	30%	--	10%	--	10%	50%	100 %
HBCC50.2		30%	10%	--	10%	50%	100 %
HBCC50.3	30%		10%	--	10%	50%	100 %
HBCC50.4	--	30%	--	10%	10%	50%	100 %
HBCC50.5	--	30%	--	10%	10%	50%	100 %

CO calculation= (0.8 *Direct method + 0.2*Indirect method)

Rubrics for assessing Course Outcome with each assessment tool:

Assignment:

Indicator				
Timeline (2)	More than two days late (0)	Two days late (1)	One day late (2)	On time (3)
Correctness (4)	All questions correct (4)	One point deducted for each incorrect answer		
Completion (4)	All questions answered (4)	One point will be deducted for each incomplete or un-attempted question		

Rubrics for the Blog:

Blog post explaining your journey. The post also explain your view of how blockchain works and how it is valued.
BlOG : 10 Marks

Learning Objective:
By the end of this activity, students will be able to explain what blockchain is and explain how they function on a technical and financial level.

Focused Activity
This lesson will be designed around the pedagogical strategy of Self Organized Learning Environments (SOLE), where the teacher will begin the lesson with a set of questions. Students will then be assigned to groups and be expected to design a presentation and share it with their class. In this lesson, the teacher will post questions about what is written in the blog and Blockchain/Crypto currencies. Students will be assigned to groups of 3 and will collaborate to answer the questions through online research. Each group will be assigned 1 of the 6 largest crypto currencies. After obtaining the answers they will design a presentation that will be

shared with the class. Approximately 35 minutes will be given for students to conduct their research and create the presentation. Following this time, students will then share their presentations with the class.

Presentation

Students will design a presentation on blockchain technology and share it with their peers. The presentation will feature one type of cryptocurrency or blockchain development platform.

Curriculum Gap identified: (with action plan)

Nil

Content beyond syllabus:

Sr.No	Topic	Date	Relevance with POs	Relevance with PSOs	Methods
1	Expert Session on " Future Opportunities in Blockchain Technology"	12-10-22	PO1(1.4.1),PO12 (12.2.1, 12.2.2)		Online platform
2	Metamask Implementation	29-08-22	PO1(1.4.1), PO5(5.2.2)		Offline -Discussion and Hands on
3	Expert session - Hands on session " Geth "	22nd September, 2022	PO1(1.4.1), PO5(5.1.1, 5.1.2,5.2.2, 5.3.1)		Offline – Hands on

Modes of content delivery

Modes of Delivery	Brief description of content delivered
Class room lecture	1. Introduction to Blockchain 2. Cryptocurrency 3. Programming for Blockchain 4. Public Blockchain 5. Private Blockchain 6. Tools and Applications of Blockchain
Blog Activity and Presentation	Blog Activity : Writing blog on introduction and applications of blockchain/bitcoin Presentation : Analysis of upcoming blockchain platforms with bitcoin and Ethereum
Quizzes	Quiz 1: on Module 1,3,6 Quiz 2: on Module 2,4,5

Text books:

1. "Mastering Bitcoin, PROGRAMMING THE OPEN BLOCKCHAIN", 2nd Edition by Andreas M. Antonopoulos, June 2017, O'Reilly Media, Inc. ISBN: 9781491954386.

2. “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, July 19, 2016, by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University Press.

Reference Books:

1. Blockchain for Beginners, Yathish R and Tejaswini N, SPD
2. Mastering Ethereum, Building Smart Contract and Dapps, Andreas M. AntonopoulosDr. Gavin Wood, O‘reilly.
3. Imran Bashir, Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Packt Publishing
4. Blockchain Basics, A non-Technical Introduction in 25 Steps, Daniel Drescher, Apress

Lesson Plan

Modes of Content Delivery:

I	Class Room Teaching and online Teaching	v	Self Learning On line Resources	Ix	Industry Visit
Ii	Tutorial	vi	Slides	X	Group Discussion
iii	Remedial Coaching	vii	Simulations/Demonstrations	xi	Seminar
Iv	Lab Experiment	viii	Expert Lecture	xii	Case Study

CLASS		TE Computer Engineering (HONOR), Semester V	
Academic Term		July- October 2022	
Subject		**Bitcoin and Cryptocurrency (HBCC501)**	
Periods (Hours) per week	***Lecture***	***4***	
	Practical		
	Tutorial		
Evaluation System		***Hours***	***Marks***
	Theory examination	3	80
	Internal Assessment	--	20
	Practical Examination	--	--
	Oral Examination	--	--
	Term work	--	--
	Total	--	100

Time Table	***Day***	***Time***
	Tuesday	8.45-9.45am
	Wednesday	8.45-9.45am
	Thursday	8.45-9.45am
	Friday	8.45-9.45am

Course Content and Lesson plan

Week	**Lecture No.**	**Date**		**Topic**	**Remarks**
		Planned	**Actual**		
				Prerequisite	
1	1	2-08-22	20-07-22	Cryptography	
	2	3-08-22	22-07-22	Hash function	
2	3	4-08-22	27-07-22	Public key cryptography	
	4	5-08-22	28-07-22	Digital signature	
				Module 1: Introduction to blockchain	
	5	29-08-22	29-07-22	What is BT, features of BT, Structure of a block, block header	
3	6	9-8-22	9-8-22	Block identifiers : block header, hash and block height	
	7	10-8-22	10-8-22	The genesis block, linking blocks in the blockchain	

	8	11-8-22	11-8-22	Merkle trees	
4	9	12-8-22	12-8-22	Simplified payment verification (SPV), blockchain demo.	
	Module 2: consensus and Mining				
	10	16-8-22	16-8-22	Decentralized consensus, Byzantine General's problem	
	11	17-8-22	17-8-22	independent verification of transactions, mining nodes	
	12	18-8-22	18-8-22	Aggregating transactions into blocks	
5	13	19-8-22	19-8-22	Constructing the block header, mining the block	
	14	23-8-22	23-8-22	Validating a new block, assembling and Selecting Chains of Blocks	
	15	24-8-22	24-8-22	Block chain Forks	
	Module 3: Introduction to Bitcoin				
6	16	25-8-22	25-8-22 (24-8-22 online)	What is Bit coin and the history of Bit coin, Getting the first bit coin	
	17	26-8-22	30-8-22	finding the current price of bit coin and sending and receiving bit coin	
					Gone for SIH competition 27
	18	30-8-22	30-8-22	Bit coin Transactions	
7					Holidays from 31/08 to 04/09due to Ganesh Festival
	Module 4:Concepts of Bitcoin				
	19	8-9-22	8-9-22	Keys and addresses, Wallets and Transactions: Public Key Cryptography and Crypto currency	UT1: 05/09, 06/09, 07/09/2022 Test postponed to 14-16/09/22 Classes on 08/09 cancelled due to placement
	20	9-9-22	13-9-22	Private and Public Keys, Bit coin Addresses, Base58 and Base58Check Encoding	Holiday: Anant Chaturdashi
9	21	13-9-22	14-9-22	Nondeterministic (Random) Wallets, Deterministic (Seeded) Wallets	
	22	14-9-22	15-9-22	HD Wallets (BIP-32/BIP-44), Wallet Best Practices, Using a Bit coin Wallets	
	23	15-09-22	16-9-22	Transaction Outputs and Inputs	Quiz 1 on Modules 1-3
10	24	16-09-22	20-9-22	Transaction Fees, Transaction Scripts and Script Language	
	25	20-09-22	21-9-22	Turing Incompleteness, Stateless	

				Verification, Script Construction (Lock + Unlock)	
	26	21-09-22	22-9-22	Pay-to-Public-Key-Hash (P2PKH), Bitcoin Addresses, Balances, and Other Abstractions	
	Module 5: Bitcoin Networks				
11	27	22-09-22	23-9-22	Peer-to-Peer Network Architecture	
	28	23-09-22	27-9-22	Node Types and Roles	
	29	27-9-22	28-9-22	Incentive based Engineering	
12	30	28-9-22	29-9-22		
	31	29-9-22	30-9-22	The Extended Bitcoin Network	
	32	30-9-22	4-10-22	Bitcoin Relay Networks	
13	33	4-10-22	5-10-22	Network Discovery, Full Nodes	
	34	5-10-22	6-10-22	Exchanging “Inventory”, Simplified Payment Verification (SPV) Nodes	
14	35	6-10-22	7-10-22	Bloom Filters	UT2 during 17-19/10/2022Quiz 2 on Modules 4-6
	36	7-10-22	11-10-22	SPV Nodes and Privacy	Quiz 2 on Module 2,4,5 on 10-12-22
Total	37	11-10-22	12-10-22	Encrypted and Authenticated Connections, Transaction Pools	
	Module 6: Blockchain applications and case studies				
	38	12-10-22	13-10-22	Domain-Specific Applications: FinTech	
	39	13-10-22	14-10-22	Internet of Things, Industrial and Manufacturing, Energy,	
	40	14-10-22		Supply chain & Logistics, Records & Identities, Healthcare (self-study)	

Submitted By	**Approved By**
Prof. Monali Shetty	ii) Dr. Sujata Deshmukh Sign:
Sign:	ii) Dr. B. S. Daga Sign:
	iii) Prof. Merly Thomas Sign:
	iv) Prof. Roshni Padate Sign:
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Date of Submission:	**Date of Approval:**
Remarks by DQAC (if any)	