Year: B. Tech III (Semester VI)

Subject Name: BlockChain 2.0 and Ethereum **Subject Code:** BTEA19626
Type of course: Honors (Group: Blockchain Technology)
Prerequisite (if any): Bitcoin and Crypto currencies

Rationale: Ethereum is a decentralized BlockChain-based software that has smart contract functionality. It is open source and used primarily to support the second-largest crypto currency in the world known as Ether. An underlying principle behind this course is to teach the students the functionality of Ethereum Blockchain, wallet, creation of smart contracts using Solidity language.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
4	0	2	5	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Contents:

Sr. No.	Contents	Total Hrs
1.	**Introduction** : From blockchain 1.0 (bitcoin) to 2.0 (Ethereum), Ethereum: A General-Purpose Blockchain, Ethereum Components, Turing Completeness, Decentralized Applications, Ether- Ethereum currency, Ethereum Wallet, Gas, Ethereum architecture, Ethereum nodes- EVM and Mining nodes, Ethereum Accounts, Ethereum Transactions, Ethereum Blocks, Smart Contracts, Writing a simple smart contracts, deploying smart contract.	06
2.	**Ethereum Network:** Basics of Ethereum client, Types of Ethereum networks, Different languages used to write Ethereum clients, Full node, Public-Private Blockchain, Ethereum client implementation using Parity and Go-Ethereum, MIST wallet, Browser Wallet, Mobile (Smartphone) Wallets.	10
3.	**Wallet and Transaction:** Nondeterministic and Deterministic Wallet, Structure of a Transaction, Nonce, Transaction Gas, Transaction Value and Data, Contract Creation transaction, Transaction creation and signing.	10
4.	**Smart Contracts and Solidity :** Life Cycle of a Smart Contract, Ethereum High-Level Languages, Building a Smart Contract with Solidity, Download and Install solidity, Ethereum Contract ABI(Application Binary Interface), Programming with solidity-Data Types, Predefined Global Variables and Functions, Transaction context, Built-in functions, Contract Definition, Functions, Contract Constructor and self-destruct, Function Modifiers, Contract Inheritance, Error Handling (assert, require, revert), Events.	14

5.	**Smart Contract Security:** Security Best Practices, Security Risks and Antipatterns, Different attacks (Reentrancy, Arithmetic Over/Underflows, Unexpected Ether, DELEGATECALL, Default Visibilities, Entropy Illusion), their vulnerabilities and Preventative Techniques.	06
6.	**Advance Concept in Solidity:** Introduction, Solidity files, Pragma, Comments, Import, Structure of a contract, State Variables, Structure, Modifiers,Events, Enumeration, Functions, Data Types, Value Types, Passing by value, Reference types, Passing by reference, Storage and memory Locations, Arrays, Address, Mapings, Global Varibale, Expression and control structures, Writing a smart contract.	08

Suggested Specification table with Marks (Theory): (For B. Tech only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	15	5	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (Revised Bloom's Taxonomy)

Reference Books:

Sr No.	Title of book /article	Author(s)	Publisher and details like ISBN
1	Mastering Ethereum: Building Smart Contracts and Dapps	Andreas M. Antonopoulos	O'Reilly Media, Inc.
2	Solidity Programming Essentials	Ritesh Modi	Packt Publishing
3	Ethereum Projects for Beginners	Kenny Vaneetvelde	Packt Publishing
4	Introducing Ethereum and Solidity	C. Dannen	Apress

Note: Students should refer to the latest editions of books

Course Outcomes (CO):

Sr. No.	CO statements	Marks % weightage
CO-1	Identify issue with Bitcoin blockchain and significance of ethereum blockchain.	20%
CO-2	Acquire the knowledge of ethereum architecture and ethereum client implementation using different implementation environment.	30%
CO-3	Write smart contracts using Solidity language.	30%
CO-4	Find potential security threats to ethereum blockchain	20%

List of Open learning website:

1. Ethereum: Novicedock (https://novicedock.com/learn/cryptocurrency/ethereum)
2. Introduction to Smart Contracts (https://docs.soliditylang.org/en/v0.4.24/introduction-to-smart-contracts.html#introduction-to-smart-contracts)
3. Solidity Tutorial (https://www.tutorialspoint.com/solidity/index.htm)

List of Experiments:

- Lab Exercises will be based on the theoretical concepts covered in the class