BLOCKCHAIN TECHNOLOGY
(INFO 4231)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) What biblical name is given to the first block in blockchain?
(a) Primal
(b) Origin
(c) Genesis
(d) Ada

(ii) What powers the Ethereum Virtual Machine?
(a) Gas
(b) Ether
(c) Bitcoin
(d) Block Rewards

(iii) When a record is submitted in a blockchain, how can you alter it?
(a) You need the public and private key to modify the record
(b) Once submitted, records cannot be altered
(c) Only a miner has the right to modify a record in a certain timeframe
(d) Only smart contracts have the right to modify the record

(iv) The transaction Merkle Tree root value in a Bitcoin block is calculated using,
(a) Hash of transactions
(b) Previous block's hash
(c) Number of transactions
(d) None of the above

(v) Which of the following problems did blockchain solve for cryptocurrencies?
(a) Anonymity
(b) Double Spending
(c) Destination of currencies
(d) None of the above

(vi) What is Proof of Stake?
(a) A certificate needed to use the blockchain
(b) A password needed to access an exchange
(c) How private keys are made
(d) A transaction and Block Verification Protocol

(vii) In a blockchain, where are smart contracts executed?
(a) On centralized servers
(b) On miners' computers
(c) On the nodes of the blockchain network
(d) On the user's mobile devices

(viii) What happens when the conditions of a smart contract are met?
(a) The contract is manually triggered
(b) The contract's actions are executed automatically
(c) The contract requires human intervention
(d) The contract is invalidated

(ix) How does blockchain enhance security in financial transactions?
(a) By centralizing data control
(b) Through decentralized ledgers and cryptographic hashing
(c) By allowing data alterations
(d) Through manual verification processes

(x) What is a "fork" in blockchain terminology?
(a) A new programming language
(b) A split in the blockchain network leading to two separate chains
(c) A type of cryptocurrency
(d) A hardware device

Fill in the blanks with the correct word

(xi) In blockchain, a _____ is a participant in the network that validates and relays transactions.

(xii) A _____ is a unique identifier for a block, created by a cryptographic hash function.

(xiii) The Ethereum blockchain introduced the concept of _____, allowing developers to build decentralized applications.

(xiv) A _____ is a type of digital ledger that is duplicated and distributed across the entire network of computer systems on the blockchain.

(xv) _____ occurs when several nodes (usually most nodes on the network) have the same blocks in their locally-validated best blockchain.

Group - B

2. (a) Describe the process of mining in blockchain and its relation to cryptographic hash functions. *[(CO1)(Analyse/IOCQ)]*

(b) Explain how does merkle tree enhance efficiency in blockchain systems? *[(CO2)(Understand/LOCQ)]*

6 + 6 = 12

3. (a) Identify the components of a block header in a blockchain. *[(CO1)(Remember/LOCQ)]*
   (b) Explain the concept of Zero-Knowledge Proofs and their applications in blockchain? *[(CO2)(Understand/LOCQ)]*

6 + 6 = 12

Group - C

4. (a) Illustrate some examples of FORTH script instructions used in Bitcoin transactions. *[(CO3)(Apply/IOCQ)]*
   (b) How does Bitcoin's difficulty adjustment work, and why is it necessary for network stability? *[(CO3)(Remember/LOCQ)]*

6 + (3 + 3) = 12

5. (a) Explain the process of Bitcoin transaction confirmation, and why is waiting for multiple confirmations recommended for larger transactions? *[(CO3)(Understand/LOCQ)]*
   (b) What factors determine Bitcoin transaction fees, and how do miners prioritize which transactions to include in a block? *[(CO3)(Remember/LOCQ)]*

(4 + 2) + (3 + 3) = 12

Group - D

6. (a) What is the Ethereum Virtual Machine (EVM), and how does it enable decentralized computation? *[(CO4)(Remember/LOCQ)]*
   (b) What are DApps, and how do they differ from traditional web applications? *[(CO4)(Remember/LOCQ)]*

(3 + 3) + (3 + 3) = 12

7. (a) What is Gas limit in Solidity? Discuss two famous smart contract frameworks for Solidity. *[(CO4)(Remember/LOCQ)]*
   (b) What are the key innovations introduced by Blockchain 3.0, and how do they improve scalability and efficiency? *[(CO4)(Remember/LOCQ)]*

(3 + 3) + (3 + 3) = 12

Group - E

8. (a) "Lack of standardization in blockchain protocols hinder interoperability between different blockchain networks" – Evaluate the statement. *[(CO6)(Evaluate/HOCQ)]*
   (b) Evaluate the probable challenges in adoption of blockchain technology? *[(CO6) (Evaluate/HOCQ)]*

6 + 6 = 12

9. (a) "High implementation and maintenance costs impacts the decision-making process for organizations considering blockchain adoption" – Justify.

[(CO6)(Analyse/IOCQ)]

(b) How can blockchain technology address the issue of counterfeit pharmaceuticals in the drug supply chain, and what implementation challenges must be overcome to ensure its effectiveness? *[(CO5)(Analyse/IOCQ)]*

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	62.5	25.0	12.5