

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(MID SEMESTER EXAMINATION SP/2025)

CLASS: BTECH  
BRANCH: CSE

SEMESTER : 6<sup>th</sup> Sem  
SESSION : SP/2025

SUBJECT: IT353 BLOCKCHAIN TECHNOLOGY

TIME: 02 Hours

FULL MARKS: 25

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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Q.1(a)	Consider a blockchain network, Where the size of each transaction is 512 bytes. Within this network one block is mined in an average of 10 minutes and the average size of the block is 1 MB. In this network proof-of-work (PoW) is used as a consensus mechanism and the current hash rate of this network is 100 TH/s and if the electricity consumption is 30 KWh per TH., then calculate how much energy is consumed per transaction.	[3]	1 3
Q.1(b)	A miner mines a block and earns 3.125 BTC as a block reward. If the current Bitcoin price is \$93,000, what is the miner's revenue in USD? What if they also earn 0.5 BTC in transaction fees?	[2]	1 3
Q.2(a)	Which hashing function does Ethereum use for Merkle root calculation?	[1]	2 1
Q.2(b)	Describe the role of Merkle trees in ensuring the integrity of data stored within a blockchain.	[1]	2 2
Q.2(c)	Consider a scenario where a block has 8 transactions are labeled as (L3, L5, L7, L0, L1, L6) in a blockchain. Calculate the Merkle root hash for this Merkle tree. Draw a suitable diagram to explain your Answer.	[3]	2 3
Q.3(a)	Alice wants to send a private message to Bob with confidentiality using asymmetric key cryptography, Which key should be used to encrypt the message, and why?	[1]	2 2
Q.3(b)	Explain the fundamental differences between hashing and encryption in terms of functionality, purpose, and usage. Define the key properties of hashing.	[4]	2 2
Q.4(a)	Consider a scenario where $f$ nodes are Byzantine nodes. How much nodes are required to tolerate $f$ Byzantine failures? Justify your answer.	[3]	2 3
Q.4(b)	In PoW, how does the difficulty level adjust in response to changes in hash rate, and what role does this coordination play in maintaining network stability and security?	[2]	3 3
Q.5(a)	What are the key steps involved in mining a new block in a Proof-of-Work blockchain? Explain with a suitable diagram.	[5]	3 2

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