School of Engineering and Applied Science, Ahmedabad University

Name: _____ Roll no.: _____ Signature: _____

Course: 'CSE542 Blockchain technologies, Approaches and Applications'
End-Semester Examination (Marks: 30, Weight: 30%)
Date: April 30th, 2025 Duration: One hour thirty minutes

Instructions

- Write answers in the box given on these papers only.
- Your answers should be precise and not vague. You should think and then write your precise answers. No marks will be given for vague answers.
- You should return this question paper and answer book at the end of examination.
- You can use any available space for rough work, if required.

Q.1 [8]	Q.2 [16]	Q.2 [6]	Total Marks (Out of 30)

[Q. 1] Attempt any 8 questions and not more than 8 questions.

1.1 How does Proof of Stake differ from Proof of Work?

1.2 Name at least one difference between blockchain and traditional databases.

1.3 Explain the concept of "mining" in the context of blockchain. What is it, and why is it needed?

1.4 What is the function of the "Genesis Block" in a blockchain?

1.5 A validator fails to propose a block during their slot. How does the network ensure progress continues?

1.6 How are new blocks added to the blockchain?

1.7 What happens if two blocks are created at the same time in a blockchain?

1.8 What is meant by double-spending, and how does blockchain prevent it?

1.9 What is a sidechain?

Q.2 Attempt any 8 questions and not more than 8 questions.

2.1 What is the 51% attack, and how does it threaten consensus in Proof of Work (PoW) blockchains?

2.2 What would logically happen if a blockchain had no consensus mechanism at all?

2.3 How has Polygon (Matic) addressed scalability on Ethereum?

2.4 If a malicious actor/node continuously broadcasts invalid blocks, how should the protocol respond?

2.5 Can a Byzantine Fault Tolerant (BFT) consensus algorithm function with only 2 nodes? Why or why not?

2.6 A smart contract runs out of gas mid-execution. What logically happens to the transaction?

2.7 What is the difference between vertical scaling and horizontal scaling in the context of blockchain?

2.8 Explain how increasing block size can affect the scalability and decentralization of a blockchain.

2.9 What are the potential drawbacks of reducing block time to improve throughput?

2.10 How does sharding help scale a Layer 1 blockchain?

2.11 What is a Layer 2 solution. How does it differ from a Layer 1 improvement for a blockchain?

[Q.3] Write answers to the following questions precisely. You should draw proper figures to explain concepts effectively. [Attempt any three questions [6]

3.1 Define the term Middleware. Which types of services do Middleware provide?

3.2 What is Consistency, Availability, and Partition Tolerance (CAP) theorem? Explain key characteristics with examples.

3.3 (a) Draw a figure to explain publisher-subscriber architecture.
(b) Explain one application scenario where publisher-subscriber architecture is used.

3.4 Mention the difference between a side chain and a rollup.