**Birla Institute of Technology & Science, Pilani**

**Work-Integrated Learning Programmes Division**

**Second Semester 2023-2024**

**Comprehensive Examination**

**(EC-3 Regular)**

Course No. : SS ZG526

Course Title : DISTRIBUTED COMPUTING

Nature of Exam : Open Book

No. of Pages = 1

# No. of Questions = 5

Weightage : 60%

Duration : 2 ½ Hours

Date of Exam : Saturday, 18/05/2024 (AN)

Note:

1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.
3. Assumptions made if any, should be stated clearly at the beginning of your answer.
4. Explain how logical clocks could be implemented in a distributed system used for managing a multi-city bus reservation system.
5. Propose an efficient implementation of vector clocks in a distributed social media platform to ensure that posts and comments are synchronized in the correct causal order. [12]
6. Illustrate the use of group communication in a distributed gaming environment where players interact in real-time.
7. Design a termination detection protocol using distributed snapshots for a complex multi-agent simulation system where agents dynamically enter and exit the simulation. [12]
8. Explain how the Chandy-Misra-Haas deadlock detection algorithm for the AND model can be applied in a distributed manufacturing control system.
9. Propose a strategy for resolving deadlocks in a distributed system that controls access to multiple satellite communication channels. [12]
10. Explain how an agreement in a failure-free system can be quickly achieved in a distributed sensor network monitoring environmental conditions across various geographic locations.
11. Design a robust consensus protocol for a distributed blockchain system that operates in a message-passing synchronous system with possible node failures, ensuring that the system maintains integrity and prevents double-spending. [12]
12. Illustrate the use of Ricart-Agrawala’s algorithm in a distributed system managing access to a limited number of electric vehicle charging stations.
13. Evaluate the performance of Maekawa’s algorithm in a distributed cloud environment where instances dynamically request and release multiple resources, discussing potential bottlenecks and improvements. [12]

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