Vellore Institute of Technology
CHENNAI

Reg. Number:	

Continuous Assessment Test (CAT) – II - March 2025

Programme	:	B.Tech.(CSE)	Semester	:	Winter 24-25
Course Code & Course Title	:	BCSE313L & Fundamentals of Fog and Edge Computing	Class Number	:	CH2024250501981
Faculty	:	Dr. V. Sakthivel	Slot	:	D1
Duration	:	90 Minutes	Max. Mark		50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.

Answer all questions

Q. No	Sub Sec.	Description	Marks
1.		A smart city traffic management system leveraging C2F2T architecture processes real-time vehicle data from IoT sensors, cameras and connected vehicles to enable low-latency traffic control and Cloud-driven analytics. A Petri Net model maps system behavior using Places for data states, Transitions for key actions and Tokens for data movement. It supports parallel real-time processing at the Fog layer, batch analytics in the Cloud, and conflict resolution for emergency scenarios, ensuring an efficient and scalable traffic management system. i. How does a Petri Net model represent data flow and transitions in a C2F2T-based traffic management system? (5 marks) ii. How can Petri Nets help resolve conflicts and prioritize emergency scenarios in a smart traffic management system? (5 marks) iii. How does the C2F2T model improve the scalability and efficiency of traffic control using Petri Net-based analysis? (5 marks)	15
2.		A smart transportation network is implementing an Internet of Vehicles (IoV) system to enhance real-time vehicle communication, traffic management and road safety. The system connects autonomous vehicles, roadside units (RSUs), cloud servers and IoT sensors to facilitate efficient data exchange and intelligent decision-making. However, as IoV operates in a highly dynamic and heterogeneous environment, it faces significant security challenges. i. What are the primary threats at the physical and network layers of the IoV security model? Propose two countermeasures for each layer. (5 marks) ii. Explain how identity authentication ensures secure communication between vehicles and infrastructure in IoV. How can blockchain or PKI-based encryption enhance data integrity? (5 marks)	10

3.		A global telecom provider is deploying Network Slicing in a Software-Defined Cloud environment to enhance the performance and efficiency of its 5G-enabled services. The system leverages Edge and Fog Computing to process data closer to end-users, reducing latency and improving resource utilization. The provider must manage multiple network slices for different applications, such as autonomous driving, smart healthcare and industrial IoT, each with unique performance and security requirements. i. Explain how Software-Defined Networking (SDN) and Network Function Virtualization (NFV) enable dynamic network slicing in Edge and Fog environments. (5 marks) ii. How can AI and automation improve the scalability and management of network slices in dynamic Edge/Fog computing environments? (5 marks)	10
4.		A smart healthcare system is deploying Fog Computing to process real-time patient data from IoT-enabled devices such as heart rate monitors, oxygen sensors and smart infusion pumps. The system must ensure low latency for emergency alerts while optimizing resource allocation, bandwidth usage and energy consumption. However, the hospital faces challenges where some Fog nodes are overloaded while others remain underutilized, leading to inefficient resource allocation. Additionally, the system must balance latency, throughput and energy efficiency while maintaining security and fault tolerance. Data offloading between Fog and Cloud must be optimized to prevent network congestion and workload balancing needs to be adaptive to handle real-time fluctuations in patient data efficiently. i. Propose an optimization model for resource allocation in Fog Computing. How does it handle dynamic workloads? (5 marks) ii. Design a multi-objective optimization strategy to balance latency, throughput and energy efficiency in a healthcare Fog system. (5 marks) iii. Suggest a workload balancing strategy for real-time patient monitoring. How does it handle sudden emergency spikes? (5 marks)	15

**********All the best **********