VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)
CHENNAI

Reg. Number:	

Continuous Assessment Test (CAT) – II - MARCH 2025

Programme	:	MCA	Semester	:	WINTER 2024-25
Course Code & Course Title	:	PMCA505L – Data Communication and Networking	Class Number	:	CH2024250501725
Faculty	:	Dr. DINAKARAN	Slot	:	E1+TE1
Duration	:	1½ Hours	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 network administrator is designing a fault-tolerant communication system for a satellite-based data transmission network. Due to high transmission noise, data corruption occurs frequently. The system currently uses 7-bit ASCII encoding for text messages but requires error detection and correction to enhance reliability. Design a Hamming Code scheme (using even parity) for a 4-bit data block and determine the number of parity bits required. Construct the Hamming Code for the binary data 1011, and show the step-by-step parity bit placement. If a single-bit error occurs at the 6th position, demonstrate how the Hamming Code can detect and correct the error.	10
2.		HData Healthcare, a leading provider of real-time patient monitoring systems, has deployed IoT-enabled health sensors in hospitals to track patient vitals (heart rate, oxygen levels, and blood pressure). These sensors transmit data to a central monitoring server that alerts doctors in case of abnormalities. However, after deployment, the IT team identified several communication challenges: • High network congestion due to multiple sensors transmitting data simultaneously. • Packet loss and out-of-order delivery affecting real-time monitoring accuracy. • Delayed acknowledgments, leading to inconsistencies in patient health reports. To address these issues, the IT team implemented the Selective Repeat ARQ Sliding Window Protocol with a window size of 5. The health sensors transmit 25 packets, but due to network interference, every third packet gets lost, requiring retransmissions. A. Illustrate the transmission timeline diagram for Go-Back-N ARQ, considering the given data loss pattern. Clearly indicate lost frames, retransmissions, and successful acknowledgments. (5 Marks) B. Based on the given scenario, find the following: (5 Marks) • Total number of frames sent successfully without retransmission. • Total number of transmissions required to send all frames.	10

		• Total number of lost frames. • Total number of discarded frames. • Total number of retransmitted frames.	
3.		A university research lab has set up a wired Ethernet network using CSMA/CD to connect four high-performance computing devices for real-time data analysis. These devices frequently transmit large datasets, but due to the shared medium, they sometimes experience collisions. The network administrator wants to analyse the vulnerable time when four devices attempt to send data. A. Explain the concept of vulnerable time in CSMA/CD. Why does it matter in shared Ethernet networks? (3 Marks) B. Derive the expression for vulnerable time (T_v) for four devices competing for access. Assume that the propagation delay for a single transmission is t1. Provide a step-by-step explanation. (5 Marks) C. Demonstrate how the p-persistent method will help to avoid collisions in this scenario? (2 Marks)	**10**
4.		SoftTech Solutions is expanding its corporate network and needs to allocate IP addresses for different departments. The IT team has decided to use a Class-Based IP Addressing Scheme but is unsure how to distribute IPs efficiently. The company has: • HR Department • Finance Department • IT Department • R&D Department A. Explain the characteristics of Class A, Class B, and Class C IP addresses and their suitability for different network sizes and justify which class is suitable for our requirement? (3 Marks) B. Using the given address block 192.168.1.0, subnet the network to allocate IPs for each department. Ensure: Each department receives a subnet with the least amount of wasted addresses. The first usable subnet is assigned to HR, the second to Finance, etc. Provide the Network Address, Subnet Mask, First Usable IP, Last Usable IP, and Broadcast Address for each department. (7 Marks)	**10**
5.		A start-up cloud services company, ABC Cloud, is setting up its data centre network to host multiple client applications. Instead of using traditional class-based addressing, the network team decides to use CIDR to allocate IPs efficiently. They have been assigned the 172.16.0.0/22 IP block. The company needs to create four subnets for different purposes: • Client Virtual Machines (2 subnetworks each with 200 hosts) • Database Servers (4 subnetworks each with 50 hosts) • Internal IT Systems (4 subnetworks, each with 20 hosts) • Backup Servers (2 subnetworks each with 10 hosts) A. Using the given CIDR block (172.16.0.0/22), subnet the network to allocate addresses efficiently for each department and provide the Subnet Address, Subnet Mask, First Usable IP, Last Usable IP, and Broadcast Address for first and last subnet of each department. (8 Marks) B. Identify the remaining address after allocation. (2 Marks)	**10**

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