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

REG.NO.: 23BBS0126

SCOPE
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2024-2025

SLOT: C2

Programme Name & Branch : B.Tech CSE with Business Systems
Course Code and Course Name : CBS3001 Computer Networks
Faculty Name(s) : Dr. Jaisankar and Dr. Chandra Mohan
Class Number(s) : --
Date of Examination : 18/03/2025 9.30 to 11AM
Exam Duration : 90 minutes Maximum Marks: 50

General instruction(s):
Answer All Questions
Course Outcomes:
CO2. Contrast different types of switching networks and analyses the performance of network.
CO3. Implement various error detection and correction mechanisms, flow control mechanisms and various routing protocols.
CO4. Design subletting and analyses the performance of network layer, Construct and examine various routing protocols.

Q. No	Question	M	CO	BL
1.	As a telecommunications engineer, you are assigned for designing a next-generation cellular network for a high-density metropolitan city. The system must support thousands of simultaneous users, ensuring high data throughput, minimal latency, and seamless connectivity. To achieve this, your team suggests Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM). (a) Compare the advantages and disadvantages of FDM and TDM in a high-traffic cellular network with thousands of simultaneous users. Which technique (FDM or TDM) would provide better performance in terms of bandwidth efficiency and dynamic adaptability in mobile networks? Justify your answer. *(6 Marks)* (b) Determine which multiplexing technique (FDM or TDM) is more effective for the following real-time cellular network applications and explain why: i) Autonomous vehicle communication and real-time traffic management in a smart city (2 marks). ii) Live broadcasting of a major sports event over a mobile network with thousands of simultaneous viewers (2 marks). FDM	10	3	3
2	(a) A satellite communication system uses ALOHA protocols to manage multiple users transmitting data over a shared wireless channel. The system transmits 500-bit frames on a 300 kbps channel. The network collectively generates 900 frames per second from all active users Calculate vulnerable time and throughput in pure ALOHA and slotted ALOHA. (6 marks) (b) For a system using Selective Repeat ARQ, draw the timing diagram for the sender and receiver windows in the following cases: 1. Frame 0 is sent and acknowledged. 2. Frames 1 and 2 are sent; both are acknowledged. 3. Frames 3, 4, and 5 are sent; NAK4 is received, requiring a	10	2	4

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	retransmission of Frame 4. 4. Frames 4, 5, 6, and 7 are sent; frames 4 through 7 are acknowledged. Draw the sender and receiver windows for each of the above scenarios, showing how Selective Repeat ARQ handles acknowledgments and retransmissions. (4 marks)			
3	A university network administrator has been assigned the 172.20.0.0/16 block and needs to subnet the network to accommodate different campus facilities and departments. The university's IP allocation requirements are as follows: • Administration Offices require 20 subnets, each needing 512 addresses. • Academic Departments require 40 subnets, each needing 256 addresses. • Student Dormitories require 10 subnets, each needing 128 addresses. • Research Labs require 20 subnets, each needing 1,024 addresses. (a) Design the subnet allocations and specify the subnet masks for each group. (8 Marks) (b) Determine the number of allocated and remaining IP addresses. (2 Marks) Marks)	10	4	4
4	A delivery service company is optimizing its route planning system using Dijkstra's shortest path algorithm. The city's road network is represented as a weighted graph, where intersections are nodes, and roads connecting them have travel times (weights) in minutes. The company wants to determine the fastest delivery route from their main warehouse (Node A) to all other delivery locations. The following road network is provided: • Intersections (Nodes): A, B, C, D, E, F • Roads and travel times (Edges with weights): A → B (6 min) A → C (2 min) B → C (3 min) B → D (5 min) C → D (1 min) C → E (4 min) D → E (2 min) D → F (3 min) E → F (5 min) (a) Apply Dijkstra's algorithm step by step to determine the shortest travel time from the warehouse (Node A) to all other intersections. (8 Marks) (b) Explain why Dijkstra's algorithm is suitable for this type of problem and discuss its efficiency in real-time logistics and navigation applications. (2 Marks)	10	4	4

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5.	(a) A cloud storage provider is transmitting five data packets from its primary data center to a backup data center. The path length of the packet1 is 4000Km and visited Routers 1, 3, 4, 6. The path length of the packet2 is 10500Km and visited Routers 1, 2, 5, 6. The path length of the packet3 is 11800Km and it is visited Routers 1, 2, 3, 6. The path length of the packet4 is 9700Km and it is visited Routers 1, 4, 6. The path length of the packet5 is 10200Km and it is visited Routers 1, 4, 5, 6. The delay at each router (including waiting and processing) is as follows: • Router 1 → 4 ms • Router 2 → 12 ms • Router 3 → 15 ms • Router 4 → 8 ms • Router 5 → 18 ms • Router 6 → 20 ms The propagation speed of the network is 2×10^8 m/s. Calculate the total delay for each packet, considering propagation delay, waiting delay and router processing delay. Determine the order in which the packets arrive at the backup data center. (7 marks) (b) A global stock exchange company needs to transmit real-time financial data between its offices in Mumbai, Delhi, and Bengaluru. The company relies on a high-speed fibre-optic network connecting these financial hubs. Network Setup: • Mumbai to Delhi: Transmission Rate = 100 Gbps, Cable Distance = 1,400 Km • Delhi to Bengaluru: Transmission Rate = 50 Gbps, Cable Distance = 2,000 Km • Bengaluru to Mumbai: Transmission Rate = 200 Gbps, Cable Distance = 1,500 Km • The propagation speed of light in fibre-optic cables is 2×10^8 m/sec. Compute the network latency (transmission delay + propagation delay) for financial data traveling from Mumbai to Bengaluru via Delhi. Ignore queuing and processing delays. *(3 Marks)*	10	2	3