A/L/TY

Reg. No: 23BCE2043

Final Assessment Test – November 2025

VIT
Vellore Institute of Technology

Course: **BCSE308L - Computer Networks**

Class NBR(s): **1462/1469/1476/1482/1496/1500/1506/1509/1514/1519/1521/1526/1529/1534/1539/1542/1548/1551** Slot: **F1+TF1**

Time: **Three Hours** Max. Marks: **100**

- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

COs	CO Statements
CO1	Interpret the different building blocks of Communication network and its architecture.
CO2	Contrast different types of switching networks and analyze the performance of network
CO3	Identify and analyze error and flow control mechanisms in data link layer.
CO4	Design sub-netting and analyze the performance of network layer with various routing protocols.
CO5	Compare various congestion control mechanisms and identify appropriate transport layer protocol for real time applications with appropriate security mechanism.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions
(10 X 10 = 100 Marks)

1. A **manufacturing company** is building a **new production wing** to house advanced assembly lines and quality control stations. This expansion will add **two new sections** to the existing plant network. The network needs to support real-time monitoring of machinery, automated data collection from sensors, video surveillance, and standard office operations for supervisors and engineers. The total area of the new wing is approximately **2,000 square meters**. Downtime must be minimized, as any network failure could halt production, leading to significant financial losses. **CO1 BL2**

Key Requirements for the New Network Segment:

- **High Reliability and Redundancy:** The network must have built-in redundancy to prevent single points of failure, ensuring **24/7 continuous operation** for the production lines.
- **Quality of Service (QoS):** Real-time data from machinery sensors and control systems (Operational Technology or **OT**) must be prioritized over standard IT traffic to prevent latency that could affect automation.
- **Security Segmentation (OT/IT):** The highly sensitive production equipment network (OT) must be strictly **isolated** from the standard corporate IT network (office PCs, emails, etc.) to prevent cyberattacks from moving laterally.
- **Environmental Considerations:** The network infrastructure (cables, access points) must be **ruggedized** to withstand the harsh manufacturing environment (dust, temperature fluctuations, and electromagnetic interference).

- **Future IoT Integration:** The design must easily accommodate the **future addition of thousands of new industrial IoT (IIoT) sensors** for predictive maintenance and energy management.

Questions Based on the Scenario:

i. What **network architecture/topology** would you recommend for the new wing? Justify your choice, specifically addressing the requirement for high reliability. **[2.5]**

ii. Suggest methods to future-proof this network for scalability. **[2.5]**

iii. What **physical media (cabling)** and **networking hardware standards** would you select to meet the environmental and data rate requirements of a manufacturing setting? **[2.5]**

iv. Suggest one primary and one secondary method to ensure **Quality of Service (QoS)** for the critical, real-time OT data traffic. **[2.5]**

2. a) Discuss the importance of using a layered approach in designing network protocols. Explain how the OSI model facilitates communication between networked systems, and describe the key responsibilities of each layer. **[7]** **CO2** **BL1**

b) A network engineer disables transport layer error checking assuming the data link layer ensures reliable transmission. What potential issues might arise from this decision, and why? **[3]**

3. A user needs to download a large video file from a server over a **packet-switched network** like the internet. The network utilizes two main principles for data transfer: the file is broken down into smaller packets, and there is a time component related to the distance the data travels. **CO2** **BL3**

Scenario Details:

File Size: 50 MB (Megabytes)

Link Bandwidth (Data Transmission Rate): 5 Mbps (Megabits per second)

End-to-End Propagation Delay: 80 milliseconds (ms)

Header Size per Packet: 20 bytes

Packet Size (Payload): 1,480 bytes

Questions Based on the Scenario:

i. **Calculate the total number of packets** required to send the entire 50 MB file. (Assume the file size refers to the payload data only, not including headers). **[2.5]**

ii. **Calculate the total transmission time** for the entire file. This is the time it takes to push all the data bits onto the link. (Ignore the header overhead for this specific calculation). **[2.5]**

iii. **Calculate the total delay** (end-to-end time) required for the **first packet** to reach the destination. (Assume the time it takes for a switch to process a packet is negligible). **[2.5]**

iv. **Explain why the total time to send the entire file** in a packet-switched network is generally closer to the sum of the transmission time and the propagation delay of the **first packet**, rather than the sum of the transmission time of *all* packets and the propagation delay of *all* packets. **[2.5]**

4. An organisation is granted the block **125.238.0.0/16**. The administrator wants to create **512 subnets**: **CO4** **BL3**

i. Find the **subnet mask** required.
ii. Find the **number of addresses** in each subnet.
iii. Find the **first and last allocatable addresses** in subnet 1.
iv. Find the **first and last allocatable address** in subnet 14.

5. i. Consider sending a 2400-byte datagram into a link that has an **MTU of 700 bytes**. Suppose the original datagram is stamped with the **identification number 422**. How many fragments are generated? What are the values in the various fields in the IP datagram(s) generated related to fragmentation? **[5]** **CO4** **BL3**

ii. Check whether the following IPv6 address notations are correct? **[2]**
   a) ::0F53:6382:AB00:67DB:BB27:7332
   b) 7803:42F2::88EC:D4BA:B75D:11CD

iii. Draw the complete structure of the IPv4 header, ensuring all fields are clearly labeled and their respective lengths in bits are indicated. **[3]**

6. i. Why is it that voice and video traffic is often sent over TCP rather than UDP in today's Internet? **[3]** **CO5** **BL2**

ii. Explain how TCP uses a congestion window and a congestion policy that avoid congestion and detect congestion after it has occurred. **[7]**

7. i. The following is a dump of a TCP header in hexadecimal format. **[6]** **CO5** **BL2**
05320017 00000001 00000000 5OO207FF 00000000
   a. What is the source port number?
   b. What the sequence number?
   c. What is the acknowledgment number?
   d. What is the length of the header?
   e. What is the type of the segment?
   f. What is the window size?

ii. What is traffic shaping? Discuss any one method used for traffic shaping. **[4]**

8. i. Describe the functions of the two FTP connections. What kinds of file types can FTP transfer? What are the three FTP transmission modes? **[6]** **CO5** **BL1**

ii. Explain different sections of Domain Name Space (tree) with neat diagram. **[4]**

9.a) i. The distance from earth to a distant planet is approximately 9 * 10^10 m. What is the channel utilization if a stop-and-wait protocol is used for frame transmission on a 64 Mbps point-to-point link? Assume that the frame size is 32 KB and the speed of light is 3*10^8 m/s. **[6]** **CO3** **BL3**

ii. A group of *N* stations share a 56-kbps pure ALOHA channel. Each station outputs a 1000-bit frame on average once every 100 sec, even if the previous one has not yet been sent (e.g., the stations can buffer outgoing frames). What is the maximum value of *N*? **[4]**

OR

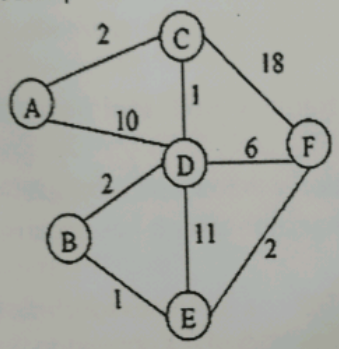
9.b) Suppose you want to transmit the message 1011 0010 0100 1011 and protect it from errors using the CRC8 polynomial X^8 +X^2 +X^1 +1. CO3 BL3

i. Use polynomial long division to determine the message that should be transmitted. [5]

ii. Suppose the leftmost bit of the message is inverted due to noise on the transmission link. What is the result of the receiver's CRC calculation? How does the receiver know that an error has occurred? [5]

10.a) i. The figure depicts an autonomous system (AS) comprising of 6 routers connected via certain links, with the numbers indicating the time cost for each link between the routers. The distance vector algorithm is used for routing packets. CO4 BL3

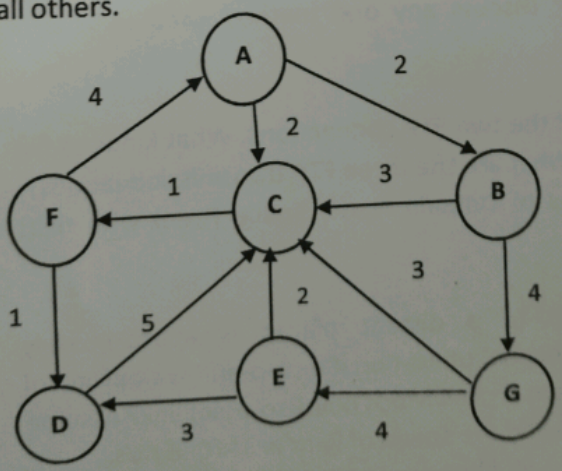
1. Write the initial distance table of Router C. [2]
2. Find the shortest path from node C to all others. [4]



ii. In distance vector what problem is encountered in deciding whether a host has become unreachable? In what circumstances is it impossible to resolve this problem? [4]

OR

10.b) In a network, the weights are given by link-state packets and contain information such as the routers, traffic costs. Find the shortest path from node F to all others. CO4 BL3



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