

Q.1 Answer the following: (1 mark each)

Short questions (1 mark each):

1. List the components of data communication.

Message - The information to be communicated.

Sender - The entity that initiates the communication.

Receiver - The entity that receives the message.

Medium - The physical or logical pathway for data transmission.

Protocol - A set of rules that govern data communication.

Encoding/Decoding - The process of converting data into signals and vice versa.

2. Define the Transmission Control Protocol (TCP).

- TCP is a connection-oriented protocol that ensures reliable data transmission by establishing a connection, sequencing data, and retransmitting lost packets.

3. What is the function of repeaters in networking?

- Repeaters regenerate and amplify signals to extend the transmission distance without signal degradation.

Objective type (1 mark each):

3. **Identify which of the following is not a type of sequence number attacks:**
- (C) Randomly assigned sequence numbers
4. **Choose the FALSE statement:**
- (C) Switch operates at the network layer. *(False, as switches operate at the Data Link Layer - Layer 2.)*
5. **Which transmission medium uses light signals to transmit data over long distances?**
- (C) Optical fiber
6. **Fill in the blanks:**
- Optical fiber cable consists of a central conductor, an insulating layer, a metallic shield, and an outer cover.
7. **Match the following network devices with their associated layer in the TCP/IP model:**
- (A) NICs → 2. Physical Layer
 - (B) Router → 3. Network Layer
 - (C) Bridge → 2. Link Layer
 - (D) Hub → 1. Physical Layer
8. **What is the primary purpose of the Transmission Control Protocol (TCP)?**
- (A) Providing connection-oriented communication
9. **How does window management in TCP help in controlling data flow?**
- (B) By regulating the amount of data a sender can transmit before receiving an acknowledgment

Q.2 Answer the following (2 or 3 mark questions):

Two Questions of 2 Marks Each:

1. **Why does optical fiber provide better performance compared to twisted pair and coaxial cables in data transmission?**
 - Optical fiber provides higher bandwidth, less signal attenuation, and is immune to electromagnetic interference, making it superior for long-distance and high-speed transmission.
2. **Differentiate between circuit switching and packet switching in terms of data transmission efficiency.**
 - Circuit switching establishes a dedicated path for the entire communication session, leading to better reliability but lower efficiency.
 - Packet switching divides data into packets and transmits them independently, improving efficiency but increasing latency.

Two Questions of 3 Marks Each:

3. **Explain the key differences between the OSI model and the TCP/IP model in terms of layers.**
 - The OSI model has 7 layers, while the TCP/IP model has 4 layers.
 - The OSI model separates Presentation and Session layers, while TCP/IP combines them within the Application layer.
 - The OSI model is more theoretical, whereas TCP/IP is practical and widely implemented.

Q.3 Attempt any TWO (5 marks each):

1. **Which type of network would be most suitable for connecting different departments in a hospital to share patient records?**
 - A **Local Area Network (LAN)** would be the most suitable choice. It provides high-speed communication within a limited area, ensuring secure and efficient data sharing among hospital departments.

2. **Analyze the differences between circuit switching, packet switching, and message switching in terms of efficiency, reliability, and delay.**
 - **Circuit Switching:** Reliable, low delay, but inefficient due to dedicated resource allocation.
 - **Packet Switching:** Efficient, scalable, but may introduce delays due to congestion.
 - **Message Switching:** No dedicated connection, stores entire messages before forwarding, leading to higher delays.
 - **Best for real-time communication:** Packet switching is ideal for applications like video conferencing.

3. **Evaluate TCP vs UDP in networking scenarios. Which protocol is better for video streaming and online banking?**
 - **TCP (Transmission Control Protocol):** Reliable, ensures data integrity, best for online banking where accuracy is crucial.
 - **UDP (User Datagram Protocol):** Faster, does not ensure delivery, best for video streaming where speed is prioritized over accuracy.

Q.4 Answer the following:

(a) Security risks of HTTP vs HTTPS (10 Marks)

- **Risks of HTTP:**
 - No encryption, making data vulnerable to interception.
 - Susceptible to MITM (Man-in-the-Middle) attacks.
 - No data integrity, increasing the risk of tampering.
- **Benefits of migrating to HTTPS:**
 - Encrypts communication using TLS/SSL, ensuring data security.
 - Enhances user trust by displaying a secure padlock.
 - Improves SEO ranking and website credibility.

Recommendation:

- Websites should use HTTPS to protect user data, maintain trust, and comply with security best practices.

(b) Impact of blocking port 25 on email communication (5 Marks)

- **Port 25** is used for SMTP (Simple Mail Transfer Protocol) to send emails. Blocking it prevents outgoing email spam but disrupts legitimate email delivery.
- **Alternative ports:**
 - **Port 587** (SMTP with authentication, recommended for email submission).
 - **Port 465** (SMTP over SSL, for encrypted email transmission).
- **How different protocols handle emails:**
 - **SMTP:** Sends emails to mail servers.
 - **IMAP (Internet Message Access Protocol):** Synchronizes emails across multiple devices.
 - **POP3 (Post Office Protocol v3):** Downloads emails to a local device and removes them from the server.

(c) Interaction of TLD servers with authoritative and root servers (5 Marks) OR Alternative to (b)

- **DNS Resolution Process:**
 1. A user queries a domain (e.g., example.com).
 2. The query goes to a **recursive DNS server**, which checks its cache.
 3. If not found, it queries a **root DNS server**, which directs it to the relevant **TLD (Top-Level Domain) server** (e.g., .com, .org).

4. The TLD server provides the IP address of the **authoritative DNS server** for that domain.
5. The authoritative server returns the IP address of the requested website.
6. The user's browser connects to the website using this IP address.

This covers all questions with the required marks distribution. Let me know if you need further clarification!