1. Topology

- What is a network topology? List and explain different types of topologies.

- Compare **Bus**, **Star**, **Ring**, **Mesh**, and **Hybrid** topologies.

- What are the advantages and disadvantages of each topology?

- Which topology is most reliable and why?

◆ 2. Baseband & Broadband Topology

- What is the difference between **Baseband** and **Broadband** transmission?

- Give real-life examples of baseband and broadband technologies.

- Explain the working of baseband transmission with a diagram.

- Why is broadband more suitable for multimedia communication?

◆ 3. Guided & Unguided Media

- What is the difference between **guided** and **unguided** transmission media?

- List types of guided media with advantages (e.g., twisted pair, coaxial, fiber optic).

- List types of unguided media (e.g., radio, microwave, infrared).

- Compare fiber optic cable and coaxial cable.

◆ 4. Data and Signal Bits Overview

- Differentiate between **data** and **signal**.

- What is a digital signal? What is an analog signal?

- How are data bits converted into signals during transmission?

- Explain with a diagram how a signal can represent binary data.

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5. Baud Rate & Bit Rate

- Define **bit rate** and **baud rate**.

- What is the relationship between baud rate and bit rate?

- If 1 symbol = 2 bits, what is the baud rate for a 2000 bps signal?

- In which case can baud rate be less than bit rate?

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6. Modulation Techniques

- What is modulation? Why is it required?

- Explain **Amplitude Modulation (AM)** with waveform.

- Explain **Frequency Modulation (FM)** and **Phase Modulation (PM)**.

- Compare AM, FM, and PM based on bandwidth, noise resistance, and usage.

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7. Multiplexing Techniques

- What is **multiplexing**? Why is it used?

- Explain **Time Division Multiplexing (TDM)** with diagram.

- Differentiate between **FDM**, **TDM**, and **STDM**.

- What is the advantage of STDM over TDM?

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8. Encoding Schemes

- What is line encoding? Why is it needed in digital transmission?

- Explain the following encoding techniques with diagrams:

    - **Return to Zero (RZ)**

    - **Non-Return to Zero (NRZ)**

    - **Bipolar Encoding (AMI)**

    - **Manchester Encoding**

○ **Differential Manchester Encoding**

● Compare Manchester and Differential Manchester encoding.

<u>Another topic</u>

Digital to Analog Modulation Techniques (ASK, PSK, FSK, QPSK)

1. What is **digital-to-analog modulation**? Why is it required?

2. Explain **Amplitude Shift Keying (ASK)** with a diagram.

3. How does **Frequency Shift Keying (FSK)** work? Give one real-life example.

4. What is **Phase Shift Keying (PSK)**? Explain its working.

5. What is **Quadrature Phase Shift Keying (QPSK)**? How is it different from PSK?

6. Compare **ASK, FSK, PSK, and QPSK** in terms of bandwidth, complexity, and noise immunity.

🔁 Transmission Methods – Synchronous & Asynchronous

7. What is the difference between **synchronous** and **asynchronous** transmission?

8. List the advantages and disadvantages of synchronous transmission.

9. Where is asynchronous transmission commonly used?

10. Compare the speed and accuracy of synchronous vs asynchronous transmission.

📊 Flow Control & Error Control

11. What is **flow control** in data communication?

12. Explain **Stop-and-Wait** and **Sliding Window** flow control mechanisms.

13. What is **error control**? Why is it important?

14. What is the difference between **error detection** and **error correction**?

15. Explain **Automatic Repeat Request (ARQ)** techniques.

❗ Error Detection Methods

16. What are the common methods used for **error detection**?

17. Explain **Parity Bit**, **Checksum**, and **CRC (Cyclic Redundancy Check)** with examples.

18. Which error detection method is most reliable and why?

19. How is error detection handled at the Data Link Layer?

🧱 Goals of Layered Protocols & Network Models

20. What are the **main goals of using a layered protocol architecture**?

21. Describe the **OSI 7-layer model** and its functions.

22. Compare the **OSI model** and **TCP/IP model**.

23. What are the key features of **IBM's SNA (Systems Network Architecture)**?

24. What is **ATM (Asynchronous Transfer Mode)**? Mention its advantages.

25. Explain how the layered approach simplifies networking.

🔁 Bit-Oriented & Character-Oriented Protocols

26. What is a **bit-oriented protocol**? Give examples.

27. What is **Binary Synchronous Communication (BSC)**?

28. Explain the **SDLC (Synchronous Data Link Control)** protocol.

29. What is a **character-oriented protocol**? How does it differ from bit-oriented?

30. Define **LAPB**, **LAPD**, and **LLC**. Mention where each is used.

31. Compare SDLC, LAPB, and LAPD based on frame structure and application

Another topic

HDLC (High-Level Data Link Control)

1. What is **HDLC**? Why is it used?

2. Explain the **frame format** of HDLC with a diagram.

3. What are the different **station types** in HDLC?

4. Define **normal response mode, asynchronous balanced mode, and asynchronous response mode** in HDLC.

5. What are the **operational states** of HDLC stations?

6. Describe **HDLC configurations**: point-to-point and multipoint.

7. What is the purpose of **access control** in HDLC?

◆ LAN Topologies (IEEE Standards)

8. What is **Ethernet (IEEE 802.3)**? Describe its frame structure.

9. How does **Token Bus (IEEE 802.4)** work? What are its advantages?

10. Explain **Token Ring (IEEE 802.5)** topology and how token passing works.

11. Compare **Ethernet, Token Bus, and Token Ring** based on speed, reliability, and usage.

◆ Introduction to WAN

12. What is a **Wide Area Network (WAN)**? Give examples.

13. What is **DQDB (IEEE 802.6)**? Where is it used?

14. Explain **FDDI (Fiber Distributed Data Interface)** and its working.

15. Compare **FDDI and DQDB** in terms of topology, speed, and media.

◆ Switching Technologies

16. What is **switching** in networking?

17. Explain **circuit switching** with an example.

18. What is **message switching**? What are its drawbacks?

19. Describe **packet switching** and its types (datagram vs virtual circuit).

20. Compare **circuit, message, and packet switching** with diagrams and examples.

◆ X.25 Protocol

21. What is **X.25**? What layers does it cover in the OSI model?

22. Explain the **frame format** used in X.25.

23. What are the main **channels** used in X.25 communication?

24. What are **packet frames** in X.25?

25. What are the basic **facilities** provided by X.25?

◆ RS-232C Standard

26. What is **RS-232C**? What is it used for?

27. Describe the **frame structure** used in RS-232C.

28. What is a **channel** in RS-232C communication?

29. What are the **limitations** of RS-232C?

◆ ISDN (Integrated Services Digital Network)

30. What is **ISDN**? How does it differ from traditional telephone networks?

31. Explain the role of **B-channel** and **D-channel** in ISDN.

32. What are **NT1, NT2, TA, and TE** devices in an ISDN setup?

33. What are the **international standards** for ISDN?

34. How does ISDN support both voice and data over a single line?

Last topic

1. Leased Lines, DSL, Digital Carriers

1. What is a **leased line** and how does it work?

2. How do **leased lines** differ from traditional internet connections?

3. What is **DSL (Digital Subscriber Line)**? What are its types?

4. Explain the working of **DSL** and its bandwidth usage.

5. What are **Digital Carriers** (like T1, T3, E1)? Where are they used?

🔁 2. Bridging & Routing (Static & Dynamic)

6. What is the difference between **bridging** and **routing**?

7. What is **static routing**? List its advantages and disadvantages.

8. What is **dynamic routing**? How does it differ from static routing?

9. Name and briefly explain common **dynamic routing protocols** (like RIP, OSPF).

🌐 3. IP, IP Addressing, ICMP, ARP, RARP

10. What is an **IP address**? Differentiate between IPv4 and IPv6.

11. Explain **classful and classless IP addressing**.

12. What is **ICMP (Internet Control Message Protocol)** used for?

13. What is the purpose of **ARP (Address Resolution Protocol)**?

14. What is **RARP (Reverse ARP)**? Where is it used?

15. How do ARP and RARP differ?

🛑 4. Congestion Control

16. What is **network congestion**?

17. What are the causes of congestion in computer networks?

18. List and briefly describe **congestion control techniques**.

19. How does **TCP handle congestion**?

🔄 5. TCP and UDP

20. What is the **difference between TCP and UDP**?

21. What are the **features of TCP (Transmission Control Protocol)**?

22. What are the **features of UDP (User Datagram Protocol)**?

23. In which scenarios is **UDP preferred over TCP**, and why?

🌐 6. Application Layer Protocols (HTTP, FTP, Telnet, SMTP)

24. What is **HTTP**? Explain its request and response format.

25. What is **FTP** and how does it differ from HTTP?

26. Explain the use of **Telnet**. Why is it considered insecure?

27. What is **SMTP (Simple Mail Transfer Protocol)**? How does it work?

🔐 7. Introduction to Data Security

28. What is the difference between **private key** and **public key cryptography**?

29. How does **public key encryption** ensure data confidentiality?

30. What are **ISO security standards** in networking?

31. Why is **data integrity** important in communication?

📱 8. Introduction to Mobile Technology

32. What are the different **topologies** used in mobile communication?

33. What is **Frequency Division Multiplexing (FDM)**?

34. What is **Time Division Multiplexing (TDM)** in mobile networks?

35. What is **Code Division Multiple Access (CDMA)**? How does it work?

🛰️ 9. Satellite Communication

36. What is **satellite communication** and how does it work?

37. What is the difference between **LEO (Low Earth Orbit)** and **GEO (Geostationary Orbit)** satellites?

38. What are the **advantages and limitations** of LEO vs GEO?

39. How is **TDM used in satellite communication**?