Assignment 02

1) Differentiate between OSI and TCP/IP model.

Ans: The difference between OSI (Open System intercommunication) model and TCP/IP (Transmission Control Protocol/Internet Protocol) model is given below:

Feature	**OSI Model**	**TCP/IP Model**
Number of Layers	7	4
Layers	1. Physical 2. Data Link 3. Network 4. Transport 5. Session 6. Presentation 7. Application	1. Network Interface (Link) 2. Internet 3. Transport 4. Application
Primary Protocols	No specific protocols; conceptual framework	TCP, IP, HTTP, FTP, SMTP, etc.
Layer Functions	- **Physical:** Transmits raw bit stream over a physical medium. - **Data Link:** Provides node-to-node data transfer (MAC, LLC). - **Network:** Determines the best physical path for data. - **Transport:** Ensures reliable data transfer. - **Session:** Manages sessions between applications. - **Presentation:** Translates, encrypts, and compresses data. - **Application:** Supports application and end-user processes.	- **Network Interface:** Handles physical addressing, data frames. - **Internet:** Handles logical addressing, routing (IP). - **Transport:** Manages end-to-end communication, error checking, and flow control (TCP, UDP). - **Application:** Provides network services to applications (HTTP, FTP, etc.).
Development	Developed by ISO (International Organization for Standardization)	Developed by DARPA (Defense Advanced Research Projects Agency)
Usage	Theoretical model, widely used for teaching and design	Practical model, basis for the Internet protocols
Protocol Dependency	Protocol-independent	Protocol-dependent (TCP/IP suite)

Feature	OSI Model	TCP/IP Model
Flexibility	More abstract, theoretically flexible	Less abstract, practically flexible
Standardization	Formal standard (ISO/IEC 7498-1)	De facto standard (RFCs)
Adoption	Less widely used in practical implementations	Widely used in real-world networking

2) Differentiate between client server and peer to peer network.

Ans: The difference between client server and p2p network is given below:

Feature	Client-Server Network	Peer-to-Peer (P2P) Network
Network Structure	Centralized	Decentralized
Role of Devices	Dedicated servers provide resources and services; clients request and use these resources.	Each device (peer) acts as both a client and a server, sharing resources directly.
Server Requirement	Requires one or more dedicated servers	No dedicated server required
Scalability	More scalable; can handle more clients by upgrading server hardware or adding more servers	Less scalable; performance can degrade as the number of peers increases
Management	Easier to manage due to centralized control	More complex to manage due to lack of centralized control
Resource Sharing	Resources are managed and distributed by the server	Resources are shared directly between peers
Security	Generally, more secure due to centralized control and dedicated security measures	Generally, less secure; security is distributed and can be inconsistent
Cost	Higher initial cost due to server hardware and software	Lower initial cost since no dedicated servers are required
Reliability	Higher reliability; server redundancy and backups can ensure data availability	Less reliable; if multiple peers go offline, data and resources may become unavailable
Examples	Websites, email servers, online banking systems	File sharing networks (e.g., BitTorrent), local file sharing between computers
Performance	Performance can be optimized through powerful server hardware	Performance can vary widely depending on the peers' capabilities and network conditions

Setup Complexity	More complex to set up and maintain due to server configurations	Easier to set up; usually requires just installing P2P software
Use Cases	Suitable for applications requiring central control and management, like enterprise networks, e-commerce platforms	Suitable for applications involving direct file sharing, collaborative projects, and decentralized services

3) Describe each layer of OSI model.

Ans: **1. Physical Layer**

- **Function:** The Physical layer is responsible for the transmission and reception of raw bit streams over a physical medium. It defines the hardware equipment involved in the data transfer, such as cables, switches, and network interface cards (NICs), as well as the electrical, optical, or radio signals used for communication.
- **Key Responsibilities:**
  - Bit rate control
  - Physical connection establishment and termination
  - Data encoding and modulation
  - Transmission medium and mode of transmission (e.g., simplex, half-duplex, full-duplex)

2. Data Link Layer

- **Function:** The Data Link layer provides node-to-node data transfer—a link between two directly connected nodes. It handles the packaging of raw bits into frames and ensures error-free transmission between nodes.
- **Key Responsibilities:**
  - Framing
  - Physical addressing (MAC addresses)
  - Error detection and correction
  - Flow control
  - Media Access Control (MAC) and Logical Link Control (LLC)

3. Network Layer

- **Function:** The Network layer is responsible for determining the best physical path for data to reach its destination across a network. It handles logical addressing, routing, and packet forwarding.
- **Key Responsibilities:**
  - Logical addressing (IP addresses)
  - Routing and forwarding
  - Packet sequencing
  - Inter-networking (connecting different networks)

4. Transport Layer

- **Function:** The Transport layer provides end-to-end communication control and error recovery. It ensures complete data transfer and handles error correction and flow control.
- **Key Responsibilities:**
  - Segmentation and reassembly
  - End-to-end connection establishment, maintenance, and termination
  - Error detection and recovery
  - Flow control (preventing network congestion)

5. Session Layer

- **Function:** The Session layer manages sessions or connections between applications. It establishes, maintains, and terminates sessions, ensuring reliable communication between systems.
- **Key Responsibilities:**
  - Session establishment, maintenance, and termination
  - Synchronization (checkpoints for data recovery)
  - Dialog control (managing two-way communication)

6. Presentation Layer

- **Function:** The Presentation layer is responsible for translating, encrypting, and compressing data. It ensures that data sent by the application layer of one system is readable by the application layer of another.
- **Key Responsibilities:**
  - Data translation (e.g., character encoding)
  - Data encryption and decryption (for security)
  - Data compression and decompression

7. Application Layer

- **Function:** The Application layer provides network services directly to end-users and applications. It interfaces with the software applications to implement a communicating component.
- **Key Responsibilities:**
  - Network process to application
  - Application protocols and services (e.g., HTTP, FTP, SMTP)
  - User interface (how users interact with the network services)

4) What are the principles behind OSI model.

Ans: Principles for OSI reference model design (service, interface, protocols):

- A layer should be created where a different abstraction is needed.
- Each layer should perform a well-defined function.
- The function of each layer should be chosen with an eye towards defining internationally standardized protocols.
- The layer boundaries should be chosen to minimize the information flow across the interfaces.

- The number of layers should be **large enough** that distinct functions should not be thrown together in the same layer and **small enough** that architecture does not become unwieldy.