**Unit-1**

**Q.1] Define The Computer Network? Compare LAN, MAN & WAN ?**

* **Computer Network:** A network consists of two or more computers that are linked in order to share resources (such as printers and CDs), exchange files, or allow electronic communications. The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.

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| **LAN** | **MAN** | **WAN** |
| LAN stands for local area network. | MAN stands for metropolitan area network. | WAN stands for wide area network. |
| Operates in small areas such as the same building or campus. | Operates in large areas such as a city. | Operates in larger areas such as country or continent. |
| LAN’s ownership is private. | MAN’s ownership can be private or public. | While WAN also might not be owned by one organization. |
| The transmission speed of a LAN is high. | While the transmission speed of a MAN is average. | Whereas the transmission speed of a WAN is low. |
| The propagation delay is short in a LAN. | There is a moderate propagation delay in a MAN. | Whereas, there is a long propagation delay in a WAN. |
| There is less congestion in LAN. | While there is more congestion in MAN. | Whereas there is more congestion than MAN in WAN. |
| LAN’s design and maintenance are easy. | While MAN’s design and maintenance are difficult than LAN. | Whereas WAN’s design and maintenance are also difficult than LAN as well MAN. |
| There is more fault tolerance in LAN. | While there is less fault tolerance. | In WAN, there is also less fault tolerance. |

**Q.2] Discuss Simple, Half Duplex and Full Duplex Communication with neat Diagram?**

* **Simple Duplex:**  In simplex mode, Sender can send the data but the sender can’t receive the data. It is a unidirectional communication.

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* **Half Duplex:** In half-duplex mode, Sender can send the data and also can receive the data one at a time. It is two-way directional communication but one at

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* **Full Duplex:** In full-duplex mode, Sender can send the data and also can receive the data simultaneously. It is two-way directional communication simultaneously.

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**Q.3] Define Point to Point and Multipoint Communication with Diagram?**

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| **Point to Point** | **Multipoint** |
| Point to point communication means the channel is shared between two devices. | Multipoint Communication means the channel is shared among multiple devices or nodes |
| In this communication, There is dedicated link between two nodes. | In this communication, link is provided at all times for sharing the connection among nodes. |
| In this communication, the entire capacity is reserved between these connected two devices with the possibility of waste of network bandwidth/ resources. | In this communication, the entire capacity isn’t reserved by any two nodes and the network bandwidth is maximum utilized. |
| In this communication, there is one transmitter and one receiver. | In this communication, there is one transmitter and many receivers. |
| In point-to-point connections, the smallest distance is most important to reach the receiver. | In Multi-point connections, the smallest distance is not important to reach the receiver. |
| Point-to-point communication provides security and privacy because communication channel is not shared. | Multi-point communication does not provide security and privacy because communication channel is shared. |
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**Q.4] Draw and Explain ISOOSI Model.**

* Established in 1947, the International Standards Organization (ISO) is a multinational body dedicated to worldwide agreement on international standards. An ISO is the Open Systems Interconnection (OSI) model is the standard that covers all aspects of network communications from ISO. It was first introduced in the late 1970s.

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* **Physical Layer :** The physical layer is concerned with transmitting raw bits over a communication channel. The design issues have to do with making sure that when one side sends a 1 bit it is received by the other side as a 1 bit, not as a 0 bit.
* **Function:** Physical characteristics of interfaces and media, Representation of bits, Data rate, Synchronization of bits, Line configuration (point-to-point or multipoint), Physical topology (mesh, star, ring or bus), Transmission mode ( simplex, half-duplex or duplex
* **Data Link Layer :** he main task of the data link layer is to transform a raw transmission facility into a line that appears free of undetected transmission errors. It does so by masking the real errors so the network layer does not see them. It accomplishes this task by having the sender break up the input data into data frames (typically a few hundred or a few thousand bytes) and transmit the frames sequentially. If the service is reliable, the receiver confirms correct receipt of each frame by sending back an acknowledgement frame.
* **Function:** Framing, Physical addressing, Flow control, Error control, Access control.
* **Network Layer** The network layer controls the operation of the subnet. A key design issue is determining how packets are routed from source to destination. Routes can be based on static tables that are ‘‘wired into’’ the network and rarely changed, or more often they can be updated automatically to avoid failed components. They can also be determined at the start of each conversation, for example, a terminal session, such as a login to a remote machine. Finally, they can be highly dynamic, being determined anew for each packet to reflect the current network load. **Functions :** Logical addressing, routing.
* **Transport Layer:** The basic function of the transport layer is to accept data from above it, split it up into smaller units if need be, pass these to the network layer, and ensure that the pieces all arrive correctly at the other end. Furthermore, all this must be done efficiently and in a way that isolates the upper layers from the inevitable changes in the hardware technology over the course of time.
* **Functions:** Port addressing, Segmentation and reassembly, Connection control ( Connection-oriented or connection-less), Flow control, Error control.
* **Session Layer:** The session layer is responsible for dialog   
  control and synchronization. It establishes, maintains and synchronize the interaction between communicating system.
* **Function**: Dialog control, Synchronization (checkpoints)
* **Presentation Layer:** The presentation layer is responsible for translation, compression, and encryption.Concerned with the syntax and semantics of the information exchanged between two system.
* **Functions:** Translation ( EBCDIC-coded text file 🡪 ASCII-coded file), Encryption and Decryption, Compression.
* **Application Layer:** The application layer is responsible for   
  providing services to the user.
* **Functions:** Network virtual terminal (Remote log-in), File transfer and access, Mail services, Directory services (Distributed Database), Accessing the World Wide Web.

**Q.5] Draw and Explain the TCP IP Model.**

* The layers in the TCP/IP protocol suite do not exactly match those in the OSI model. The original TCP/IP protocol suite was defined as having four layers: host-to-network, internet, transport, and application. However, when TCP/IP is compared to OSI, we can say that the TCP/IP protocol suite is made of five layers: physical, data link, network, transport, and application.

1. **Internet Layer:** TCP/IP support the Internet Protocol IP ( unreliable), IP is a host-to-host protocol.

**Supporting protocols:** Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP), Internet Control Massage Protocol (ICMP), Internet Group Massage Protocol (IGMP)

1. **Transport Layer:** Process-to-process protocol: User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transmission Protocol (SCTP)

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**Q.6] Define the Network Topology. Enlist the Different type of Network Topologies. Explain any two network topologies with neat Diagram.**

* **Network Topology:** A network is a set of devices (nodes) connected by communication links. A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network**.**
* **MESH Topology:** Every device has a dedicated point-to-point link to every other devices**,** Dedicated- **a)** Link carries traffic only between the two devices it connects. **b)** A fully connected mesh network has n(n-1)/2 physical channels to link n devices. **c)** Every device on the network must have n-1 input/output (I/O) ports.
* **Advantage:** Less traffic, robust, secure, easy to maintain

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* **Disadvantage:** Need more resource (cable and ports), expensive
* **STAR Topology:** Each device has a dedicated point-to-point link only to a central controller, usually called a hub, No direct traffic and link between devices
* **Advantages:** Less expensive, Easy to install and reconfigure, Robustness
* **Disadvantage:** Single point of failure
* **BUS Topology:** A multipoint topology, All devices are linked through a backbone cable, Nodes are connected to the bus cable by drop lines and taps.

**Drop line:** A connection running between the device and the main cable

**Tap:** A connector that either splices into the main cable or punctures the sheathing of a cable to create a contact with the metallic core

* **Advantage:** Ease of installation
* **Disadvantages:** Difficult reconnection and fault isolation, Broken or fault of the bus cable stops all transmission

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* **RING Topology:** Each device is dedicated point-to-point connection only with the two devices on either side of it, A signal is passed along the ring in the direction, from device to device, until it reaches its destination, Each device in the ring incorporates a repeater
* **Advantages:** Relatively easy to install and reconfigure, Fault isolation is simplified
* **Disadvantage:** Unidirectional traffic

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* **Tree Topology:** Tree topologies integrate multiple topologies together
* **Advantages:** 
  + Point-to-point wiring for individual segments.
  + Supported by several hardware and software venders.
* **Disadvantages:**
  + Overall length of each segment is limited by the type of cabling used.
  + If the backbone line breaks, the entire segment goes down.
  + More difficult to configure and wire than other topologies

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* **A hybrid topology:** a star backbone with three bus networks

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* **Self-Study:** Uses of computer networks, Types of computer networks, Network technology- from local to global, Examples of networks, Network protocols, Reference models, Standardization, policy, legal, and social issues.