SUMMER – 2022 EXAMINATION

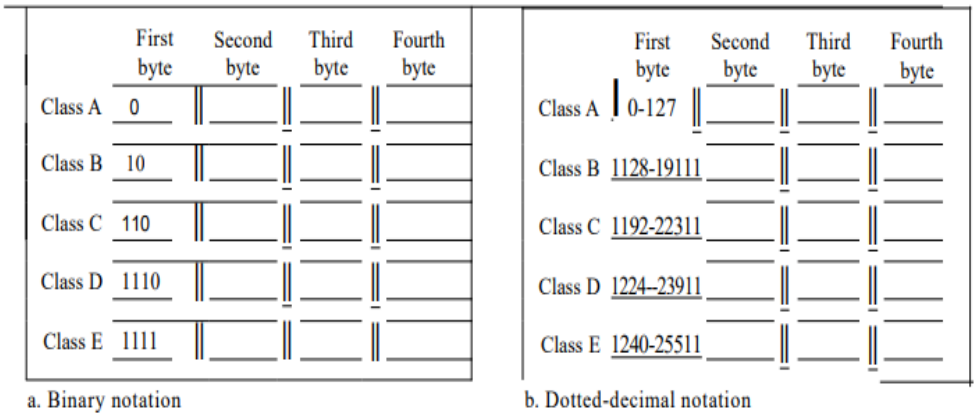
Subject Name:Data Communication & Computer Network **Model Answer** **Subject Code:** 22414

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.
8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1		**Attempt any FIVE of the following:**	**10 M**
	a)	**Define computer Network.**	**2 M**
	Ans	A computer network is a system that connects various independent computers in order to share information (data) and resources. OR A computer network is a collection of two or more computer systems that are linked together. A network connection can be established using either cable or wireless media. OR A computer network is defined as a system that connects two or more computing devices for transmitting and sharing information.	Correct definition-2 M
	b)	**List types of multiplexing.**	**2 M**

	Ans	Following are the types of multiplexing: 1. Frequency-Division Multiplexing 2. Wavelength-Division Multiplexing 3. Time-Division Multiplexing a) Synchronous Time-Division Multiplexing b) Asynchronous Time-Division Multiplexing	Correct types-2 M
	c)	**List different types of errors**	**2 M**
	Ans	**Single-Bit Error:** The term single-bit error means that only 1 bit of a given data unit (such as a byte, character, or packet) is changed from 1 to 0 or from 0 to 1. **Burst Error:** The term burst error means that 2 or more bits in the data unit have changed from 1 to 0 or from 0 to 1.	2 types-2 M
	d)	**List different types of network connecting devices.**	**2 M**
	Ans	1. Hub a. Passive Hubs b. Active Hubs 2. Bridges 3. Two-Layer Switches 4. Routers 5. Three-Layer Switches 6. Gateway 7. Modem 8. Repeaters	Any 4 devices-2 M
	e)	**Define:** **(i) Bit rate** **(ii) Baud rate**	**2 M**
	Ans	i. <u>Bit rate:</u> Bit rate is defined as the transmission of a number of bits per second. Bit Rate cannot determine the bandwidth. ii. <u>Baud rate:</u> Baud rate is defined as the number of signal units per second. Baud rate can determine the amount of bandwidth necessary to send the signal.	Correct definition -1 M each
	f)	**List classes of IP addresses.**	**2 M**
	Ans	Class A, Class B, Class C, class D and Class E	Correct types-2 M

			
	g)	**Define following terms: -** **(i) Protocol** **(ii) Bandwidth**	**2 M**
	Ans	**i) <u>Protocol:</u>** A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but not communicating, just as a person speaking French cannot be understood by a person who speaks only Japanese. **ii) <u>Bandwidth:</u>** The bandwidth of a composite signal is the difference between the highest and the lowest frequencies contained in that signal. For example, if a composite signal contains frequencies between 1000 and 5000, its bandwidth is 5000 - 1000, or 4000.	Correct definition- 1 M each
2.		**Attempt any <u>THREE</u> of the following:**	**12 M**
	a)	**Describe modes of communication.**	**4 M**
	Ans	○ The way in which data is transmitted from one device to another device is known as **transmission mode**. ○ The transmission mode is also known as the communication mode. The Transmission mode is divided into three categories: ○ Simplex mode ○ Half-duplex mode ○ Full-duplex mode **Simplex mode**	List-1M All 3 modes Explanation with figure- 3M

- In Simplex mode, the communication is unidirectional, i.e., the data flow in one direction.
- A device can only send the data but cannot receive it or it can receive the data but cannot send the data.
- This transmission mode is not very popular as mainly communications require the two-way exchange of data. The simplex mode is used in the business field as in sales that do not require any corresponding reply.
- The radio station is a simplex channel as it transmits the signal to the listeners but never allows them to transmit back.
- Keyboard and Monitor are the examples of the simplex mode as a keyboard can only accept the data from the user and monitor can only be used to display the data on the screen.

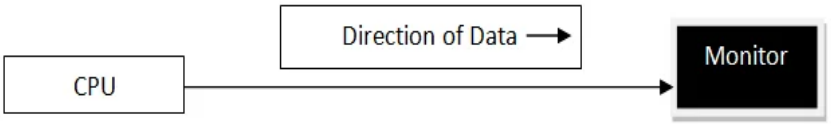


Fig: Simplex mode

Half-Duplex mode

- In a Half-duplex channel, direction can be reversed, i.e., the station can transmit and receive the data as well.
- Messages flow in both the directions, but not at the same time.
- The entire bandwidth of the communication channel is utilized in one direction at a time.
- In half-duplex mode, it is possible to perform the error detection, and if any error occurs, then the receiver requests the sender to retransmit the data.
- A **Walkie-talkie** is an example of the Half-duplex mode. In Walkie-talkie, one party speaks, and another party listens. After a pause, the other speaks and first party listens. Speaking simultaneously will create the distorted sound which cannot be understood.

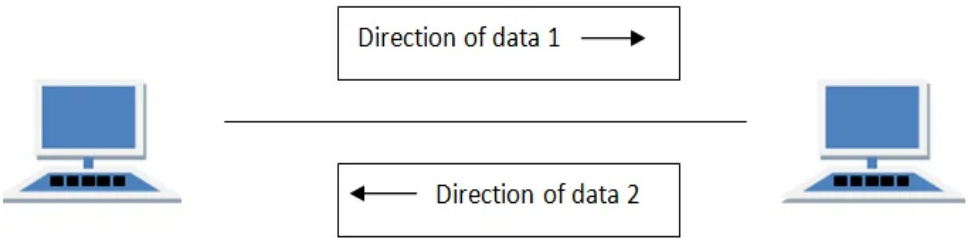


Fig: Half-Duplex mode

Full-duplex mode

- In Full duplex mode, the communication is bi-directional, i.e., the data flow in both the directions.
- Both the stations can send and receive the message simultaneously.
- Full-duplex mode has two simplex channels. One channel has traffic moving in one direction, and another channel has traffic flowing in the opposite direction.
- The Full-duplex mode is the fastest mode of communication between devices.
- The most common example of the full-duplex mode is a telephone network. When two people are communicating with each other by a telephone line, both can talk and listen at the same time.

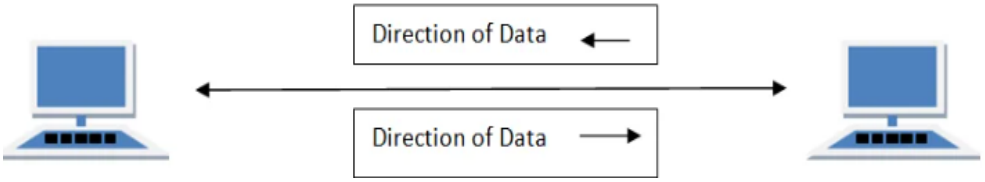


Fig: Full -Duplex mode

	b)	**Explain 802.11 Architecture.**	**4 M**
	Ans	**<u>IEEE 802.11</u>** IEEE has defined the specifications for a wireless LAN, called IEEE 802.11, which covers the physical and data link layers **<u>Architecture:</u>** The standard defines two kinds of services: the basic service set (BSS) and the extended service set (ESS). **<u>Basic Service Set</u>** IEEE 802.11 defines the basic service set (BSS) as the building block of a wireless LAN.	**BSS:** explanation with fig:2M **ESS:** explanation with fig:2M

A basic service set is made of stationary or mobile wireless stations and an optional central base station, known as the access point (AP).
Figure shows two sets in this standard. The BSS without an AP is a stand-alone network and cannot send data to other BSSs. It is called an ad hoc architecture.

In this architecture, stations can form a network without the need of an AP; they can locate one another and agree to be part of a BSS. A BSS with an AP is sometimes referred to as an infrastructure network.

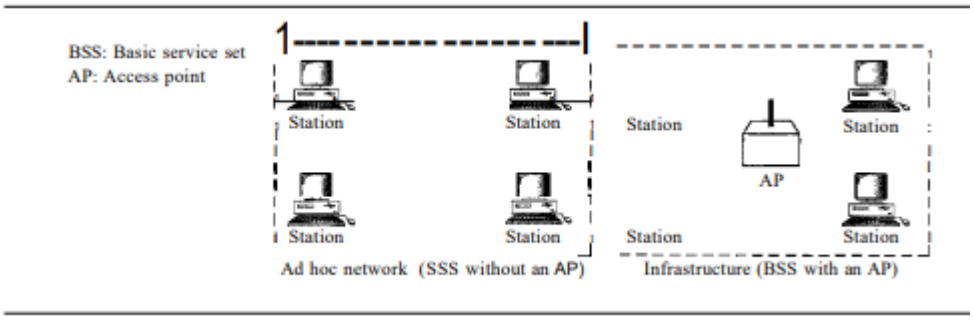


Fig:basic service set (BSS)

Extended Service Set

An extended service set (ESS) is made up of two or more BSSs with APs. In this case, the BSSs are connected through a distribution system, which is usually a wired LAN. The distribution system connects the APs in the BSSs. IEEE 802.11 does not restrict the distribution system; it can be any IEEE LAN such as an Ethernet. Note that the extended service set uses two types of stations: mobile and stationary. The mobile stations are normal stations inside a BSS. The stationary stations are AP stations that are part of a wired LAN. Figure shows an ESS.

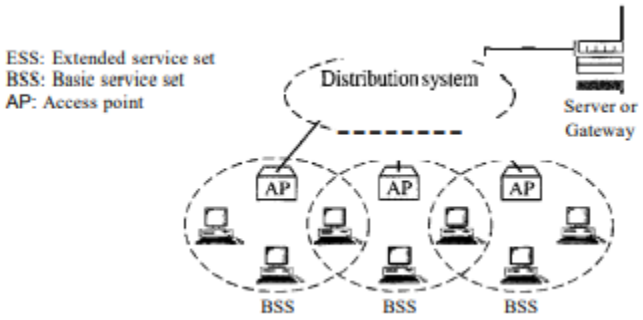


Fig: Extended service set (ESS)

When BSSs are connected, the stations within reach of one another can communicate without the use of an AP. However, communication between two stations in two different BSSs usually occurs via two APs. The idea is similar to communication in a cellular network if we consider each BSS to be a cell and each AP to be a base station. Note that a mobile station can belong to more than one BSS at the same time.

	c)	**Explain Bluetooth Architecture.**	**4 M**
	Ans	Bluetooth technology is the implementation of a protocol defined by the IEEE 802.15 standard.	Explanation of Piconet

Architecture

Bluetooth defines two types of networks: piconet and scatternet.

with diagram-2M

Piconets:

A Bluetooth network is called a piconet, or a small net. A piconet can have up to eight stations, one of which is called the primary;t the rest are called secondaries. All the secondary stations synchronize their clocks and hopping sequence with the primary. Note that a piconet can have only one primary station. The communication between the primary and the secondary can be one-to-one or one-to-many. Figure shows a piconet.

Explaination of Scatternet with diagram-2M

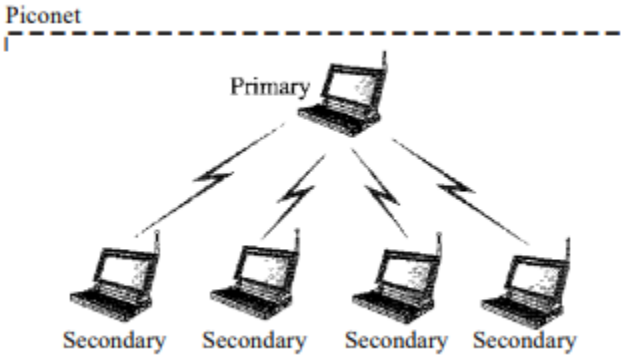


Fig: Piconet

Although a piconet can have a maximum of seven secondaries, an additional eight secondaries can be in the parked state. A secondary in a parked state is synchronized with the primary, but cannot take part in communication until it is moved from the parked state. Because only eight stations can be active in a piconet, activating a station from the parked state means that an active station must go to the parked state.

Scatternet:

Piconets can be combined to form what is called a scatternet. A secondary station in one piconet can be the primary in another piconet. This station can receive messages from the primary in the first piconet (as a secondary) and, acting as a primary, deliver them to secondaries in the second piconet. A station can be a member of two piconets. Figure illustrates a scatternet.

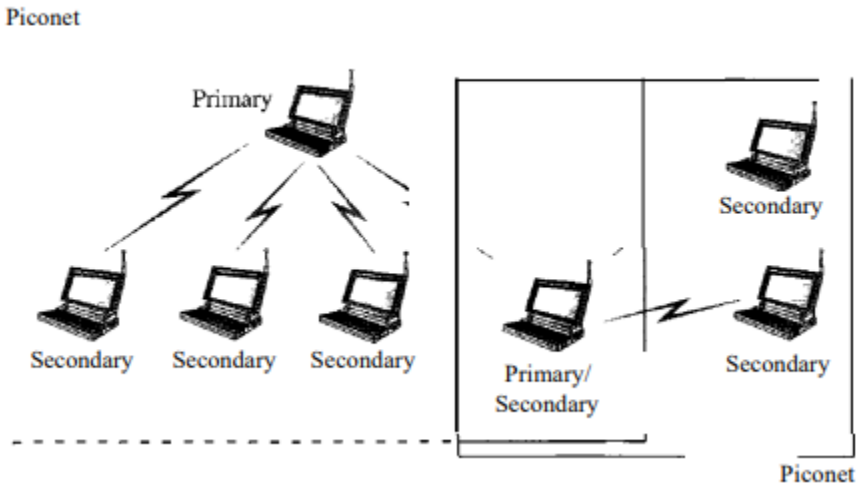


Fig: Scatternet

	d)	**Draw a neat diagram of twisted pair cable and state its types.**	**4 M**
	Ans	A twisted pair consists of two conductors (normally copper), each with its own plastic insulation, twisted together, as shown in Figure.	Diagram with naming-2 m All types -2M

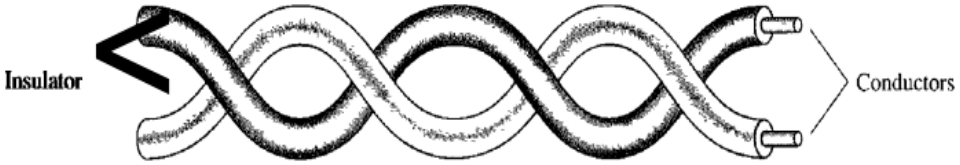


Fig: Twisted pair cable

<u>Types of Twisted–Pair Cables</u>

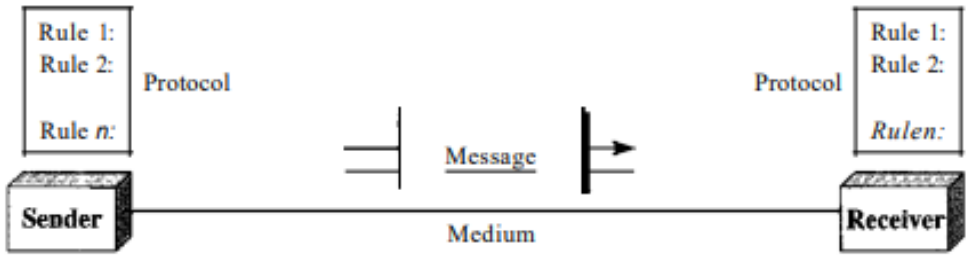
There are two types of twisted pair cables −

- Unshielded Twisted Pair (UTP): These generally comprise of wires and insulators.

Unshielded twisted pair cables are classified into seven categories −

- Category 1 − UTP used in telephone lines with data rate < 0.1 Mbps
- Category 2 − UTP used in transmission lines with a data rate of 2 Mbps
- Category 3 − UTP used in LANs with a data rate of 10 Mbps
- Category 4 − UTP used in Token Ring networks with a data rate of 20 Mbps
- Category 5 − UTP used in LANs with a data rate of 100 Mbps
- Category 6 − UTP used in LANs with a data rate of 200 Mbps
- Category 7 − STP used in LANs with a data rate of 10 Mbps

- Shielded Twisted Pair (STP): STP cable has a metal foil or braided mesh covering

		that encases each pair of insulated conductors.	
3.		**Attempt any THREE of the following:**	**12 M**
	a)	**Describe the components of data communication with neat diagram.**	**4 M**
	Ans	**Components of data communication: -**  Figure: components of data communication. 1. **Message** - It is the information to be communicated. Popular forms of information include text, pictures, audio, video etc. Text is converted to binary, number doesn't converted, image is converted to pixels, etc. 2. **Sender** - It is the device which sends the data messages. It can be a computer, workstation, telephone handset etc. 3. **Receiver** - It is the device which receives the data messages. It can be a computer, workstation, telephone handset etc. 4. **Transmission Medium** - It is the physical path by which a message travels from sender to receiver. Some examples include twisted-pair wire, coaxial cable, radio waves etc. 5. **Protocol** - It is a set of rules that governs the data communications. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but not communicating.	2M for block diagram 2M for explanations
	b)	**Explain LRC with example.**	**4 M**
	Ans	Longitudinal redundancy check • Longitudinal Redundancy Check (LRC) is the error detection method which is used by upper layers to detect error in data. • The other name for LRC is 2-D parity check. In this method, data which the users want to send is organized into tables of rows and columns. • To detect an error, a redundant bit is added to the whole block after addition this block is transmitted to receiver side. • This redundant bit is used by receiver to detect error. If there is no error, receiver accepts the data and discards the redundant row of bits.	2M for explanation and 2M for example

Example

If a block of 32 bits is to be transmitted, it is divided into matrix of four rows and eight columns which as shown in the following figure:

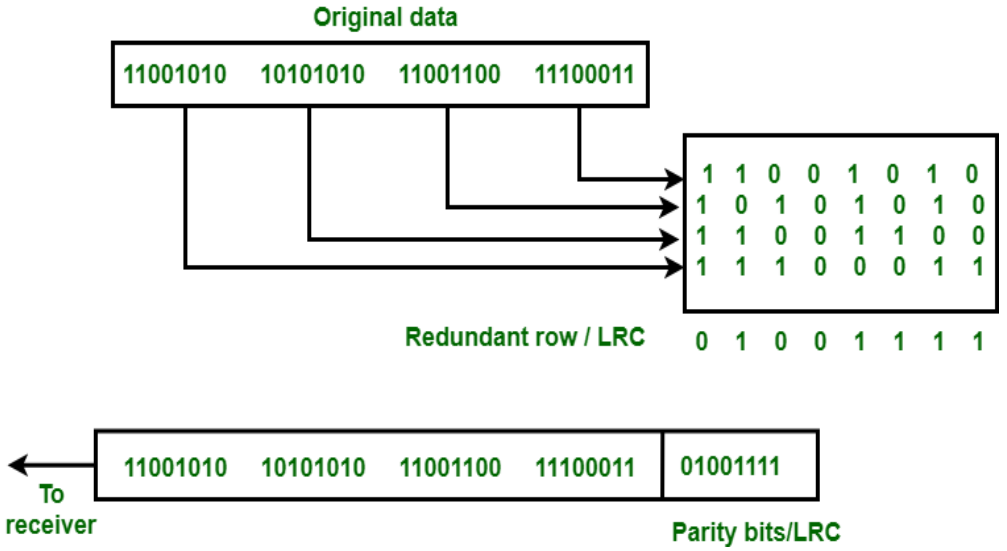
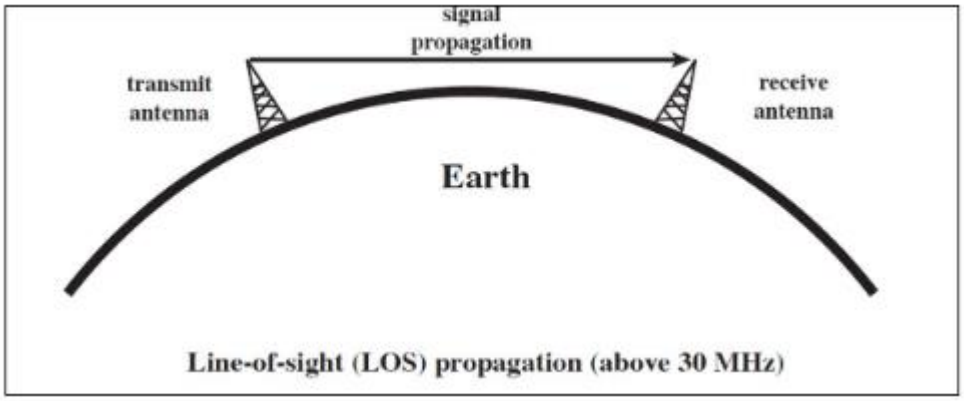


Figure: LRC

In this matrix of bits, a parity bit (odd or even) is calculated for each column. It means 32 bits data plus 8 redundant bits are transmitted to receiver. Whenever data reaches at the destination, receiver uses LRC to detect error in data.

Advantage:
LRC is used to detect burst errors.

	c)	**Describe line of sight transmission.**	**4 M**
	Ans	**Line of sight communication** • Line of sight (LoS) is a type of communication that can transmit and receive data only where transmit and receive stations are in view of each other without any sort of an obstacle between them. • Transmitting and receiving media should be in line of sight. • In line of sight communication, very high frequency signals are transmitted in straight lines directly from antenna to antenna. • Antenna must be directional, facing each other, and either tall enough or close enough together not to be effected by the curvature of earth. • Above 30 MHz, neither ground wave nor sky wave propagation modes operate, and communication must be by line of sight • For satellite communication, a signal above 30 MHz is not reflected by the ionosphere and therefore a signal can be transmitted between an earth station and a satellite overhead that is not beyond the horizon. For ground-based communication,	Explanation-3M Diagram-1M

		the transmitting and receiving antennas must be within an effective line of sight of each other. This is better understood with the help of the following diagram:  Line-of-sight (LOS) propagation (above 30 MHz) The figure depicts this mode of propagation very clearly. The line-of-sight propagation will not be smooth if there occurs any obstacle in its transmission path. As the signal can travel only to lesser distances in this mode, this transmission is used for infrared or microwave transmissions.	
	d)	**Describe various mobile generations in detail.**	**4 M**
	Ans	**1G – First generation** 1G refers to the first generation of wireless mobile communication where analog signals were used to transmit data. It was introduced in the US in early 1980s and designed exclusively for voice communication. **Features:** • Speeds up to 2.4 kbps • Poor voice quality • Large phones with limited battery life • No data security • Used analog signals **2G-Second generation** 2G refers to the second generation of mobile telephony which used digital signals for the first time. It was launched in Finland in 1991 and used GSM technology. 2G networks used digital technology. It implemented the concept of CDMA and GSM. Provided small data services like sms and mms. 2G capabilities are achieved by allowing multiple users on a single channel via multiplexing.	1M for any four correct generations along with two features

Features:

- Data speeds up to 64 kbps
- Text and multimedia messaging possible
- Better quality than 1G
- 2G requires strong digital signals to help mobile phones work. If there is no network coverage in any specific area, digital signals would weak.
- These systems are unable to handle complex data such as Videos.

When GPRS technology was introduced, it enabled web browsing, e-mail services and fast upload/download speeds. 2G with GPRS is also referred as 2.5G, a step short of next mobile generation

3G- Third generations

Third generation (3G) of mobile telephony began with the start of the new millennium and offered major advancement over previous generations.

3G has multimedia services support along with streaming. In 3G universal access and portability across different devices types are made possible.

3G increased the efficiency of frequency spectrum by improving how audio is compressed during a call. so more simultaneous calls can take place in same frequency range.

Like 2G, 3G evolved into 3.5G and 3.75G as more features were introduced in order to bring about 4G.

Features:

- Data speeds of 144 kbps to 2 Mbps
- High speed web browsing
- Running web based applications like video conferencing, multimedia e-mails, etc.
- Fast and easy transfer of audio and video files
- 3D gaming
- TV Streaming/ Mobile TV/ Phone Calls MUM1 Large Capacities and Broadband Capabilities
- Expensive fees for 3G Licenses Services

4G- Fourth generation

The main purpose of 4G is to provide high speed, high quality and high capacity to users while improving security and lower the cost of voice and date services, multimedia and internet over IP.

Fourth Generation (4G) mobile phones provides broadband cellular network services and is successor to 3G mobile networks. It provides an all IP based cellular communications. The capabilities provided adhere to IMT-Advanced specifications as laid down by International Telecommunication Union (ITU).

Features

- It provides an all IP packet switched network for transmission of voice, data, signals and multimedia.
- It aims to provide high quality uninterrupted services to any location at any time.
- As laid down in IMT-Advanced specifications, 4G networks should have peak data rates of 100Mbps for highly mobile stations like train, car etc., and 1Gbps for low mobility stations like residence etc.
- It also lays down that 4G networks should make it possible for 1 Gbps downlink over less than 67 MHz bandwidth.
- They provide have smooth handoffs across heterogeneous network areas.

5G- Fifth generation

- 5G is the 5th generation mobile network. It is a new global wireless standard after 1G, 2G, 3G, and 4G networks. 5G enables a new kind of network that is designed to connect virtually everyone and everything together including machines, objects, and devices.
  5G wireless technology is meant to deliver higher multi-Gbps peak data speeds, ultra low latency, more reliability, massive network capacity, increased availability, and a more uniform user experience to more users. Higher performance and improved efficiency empower new user experiences and connects new industries.
  Features
- High Speed, High Capacity 5G technology providing large broadcasting of data in Gbps.
- Multi - Media Newspapers, watch T. V pro clarity as to that of an HD Quality.
- Faster data transmission that of the previous generations.
- Large Phone Memory, Dialing Speed, clarity in Audio/Video.
- Support interactive multimedia, voice, streaming video, Internet and other
- 5G is More Effective and More Attractive.

4.		**Attempt any <u>THREE</u> of the following:**	**12 M**
	a)	**Consider a network with 8 computers, which network architecture should be used peer to peer or Client Server? Justify the answer**	**4 M**
	Ans	In the question it is given that we are supposed to consider eight computers. Both architecture can be considered depending upon the requirement. for eight computers I would like to prefer Peer to Peer network architecture. Because	For valid explanation 4M : either peer to peer or client-

- The number of computers or devices in the network is less than 15. For peer to peer network less than 10 devices shows good performance.
- Data security is not the top priority
- Networking is mainly required for hardware sharing.
- Advanced sharing is not required.
- Additional networking features are not required.
- The administrator personally knows all users of the network.
- The above conditions are usually fulfilled in home and small office networks. Thus, peer-to-peer networking is mostly used in home and small office networks.
- Less costly

Also if security is in priority and cost is not the consideration then I would prefer client server network it will provide a stable network.

server

b) Compare packet switched and circuit switched network. **4 M**

Ans **Packet switching and circuit switching comparison**

1 mark for each difference: any

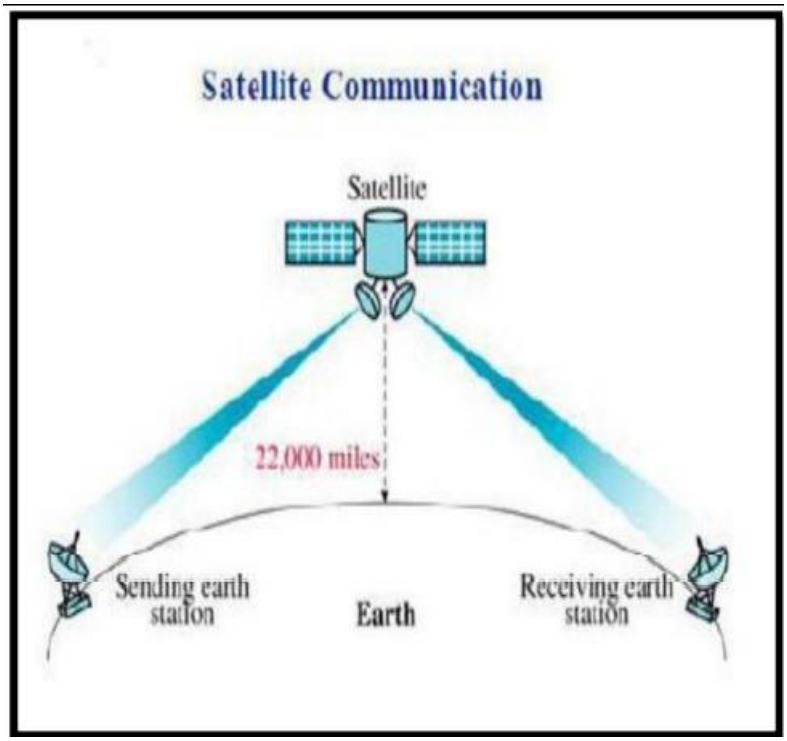
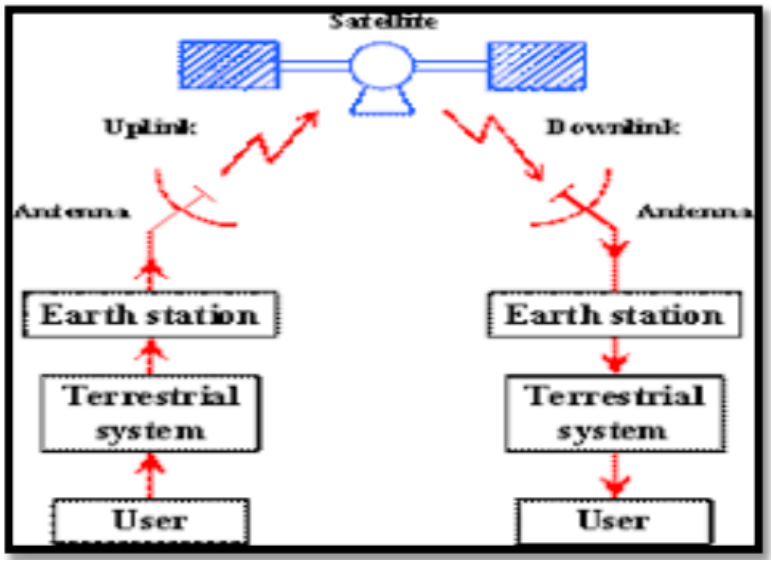
4 points 4 M

Packet switching	**circuit switching**
In-circuit switching has there are 3 phases: i)Connection Establishment. ii) Data Transfer. iii) Connection Released.	In Packet switching directly data transfer takes place.
In-circuit switching, each data unit knows the entire path address which is provided by the source.	In Packet switching, each data unit just knows the final destination address intermediate path is decided by the routers.
In-Circuit switching, data is processed at the source system only	In Packet switching, data is processed at all intermediate nodes including the source system.
Resource reservation is the feature of circuit switching because the path is fixed for data transmission.	There is no resource reservation because bandwidth is shared among users.
Wastage of resources is more in Circuit Switching	Less wastage of resources as compared to Circuit Switching
Transmission of the data is done by the source.	Transmission of the data is done not only by the source but also by the intermediate routers.
Congestion can occur during the connection establishment phase because there might be a case where a request is being made for a channel but the channel is already occupied.	Congestion can occur during the data transfer phase; a large number of packets comes in no time.
Circuit switching is not convenient for	Packet switching is suitable for handling

		handling bilateral traffic.	bilateral traffic.	
		In-Circuit switching, the charge depends on time and distance, not on traffic in the network.	In Packet switching, the charge is based on the number of bytes and connection time.	
		Recording of packets is never possible in circuit switching.	Recording of packets is possible in packet switching.	
		In-Circuit Switching there is a physical path between the source and the destination	In Packet Switching there is no physical path between the source and the destination	
		Circuit Switching does not support store and forward transmission	Packet Switching supports store and forward transmission	
		Call setup is required in circuit switching.	No call setup is required in packet switching.	
		In-circuit switching each packet follows the same route.	In packet switching packets can follow any route.	
		The circuit switching network is implemented at the physical layer.	Packet switching is implemented at the datalink layer and network layer	
		Circuit switching requires simple protocols for delivery.	Packet switching requires complex protocols for delivery.	
	c)	**List the protocols related to all layers of OSI reference model**		**4 M**
	Ans			1 M for two protocol each layer. consider any four layer in case of all correct.

OSI MODEL	PROTOCOLS
Application Layer	FTP,HTTP,Telnet
Presentation Layer	JPEG,MPEG
Session Layer	NFS,SQL,PAP
Transport Layer	TCP,UDP
Network Layer	IPv4,IPv6
Data Link Layer	ARP,CDP,STP
Physical Layer	Ethernet,Wi-Fi

	d)	**Explain satellite communication.**	**4 M**

	Ans	1. Satellite is a manmade system which is kept in continuous rotation around the earth in a specific orbit at a specific height above the earth and with specific speed. **2.** In satellite communication, signal transferring between the sender and receiver is done with the help of satellite. **3.** In this process, the signal which is basically a beam of modulated microwaves is sent towards the satellite called UPLINK (6 GHz). **4.** Then the satellite amplifies the signal and sent it back to the receiver's antenna present on the earth's surface called as DOWNLINK (4Ghz), as shown in the diagram given   5 . As the entire signal transferring is happening in space. Thus this type of communication is known as space communication. The satellite does the functions of an antenna and the	2M diagram 2M for explanation

		repeater together. If the earth along with its ground stations is revolving and the satellite is stationery, the sending and receiving earth stations and the satellite can be out of sync over time. 6. Therefore Geosynchronous satellites are used which move at same RPM as that of the earth in the same direction. 7. So the relative position of the ground station with respect to the satellite never changes. 8. However 3 satellites are needed to cover earth's surface entirely.	
	e)	**Describe the process of DHCP server configuration.**	**4 M**
	Ans	**Configuring the DHCP Server** To configure the DHCP server: 1. **From the Control Panel, go to Administrative Tools >> Computer Management >> Services and Application >> DHCP.** 2. **From the Action menu, select New Scope**. The New Scope wizard is displayed. 3. **Enter the following information as prompted**: • Scope name and description: • IP address range (for example, 192.168.0.170 to 192.168.0.171) • Subnet mask (for example, 255.255.255.0) • Add exclusions (do not exclude any IP addresses) • Lease duration (accept the default of 8 days) • Router (default gateway) of your subnet (for example, 192.168.0.1) • Domain name, WINS server (these are not needed) • Activate Scope? (select "Yes, I want to activate this scope now") 4. **Click Finish to exit the wizard.** The contents of the DHCP server are listed. 5. **Right-click Scope [iPad dress] scope-name and select Properties.** 6. **In the Scope Properties box, click the Advanced tab.** 7. **Select BOOTP only**, set the lease duration to Unlimited, and click OK. 8**. Right-click Reservations**. The Controller A Properties box is displayed. 9. Enter the IP address and the MAC address for Controller A. Click Add. The Controller B Properties box is displayed 10. **Enter the IP address and the MAC address for Controller B. Click Add**. The controllers are added to the right of the Reservations listing.	Step by step procedure 4M

		11. **Right-click Scope [iPad dress] scope-name to disable the scope.** **12. Click Yes to confirm disabling of the scope.** **13. Right-click Scope and select Activate.**	
5.		**Attempt any <u>TWO</u> of the following:**	**12 M**
	a)	**Explain the working of hub, switch and bridge.**	**6 M**
	Ans	**I. Hub:** Hubs are networking devices operating at a physical layer of the OSI model that are used to connect multiple devices in a network. They are generally used to connect computers in a LAN. **Working:** A hub has many ports in it. A computer which intends to be connected to the network is plugged in to one of these ports. When a data frame arrives at a port, it is broadcast to every other port, without considering whether it is destined for a particular destination device or not. Features of Hubs • A hub operates in the physical layer of the OSI model. • A hub cannot filter data. It is a non-intelligent network device that sends message to all ports. • It primarily broadcasts messages. So, the collision domain of all nodes connected through the hub stays one. • Transmission mode is half duplex.	2M each for Hub, switch and Bridge

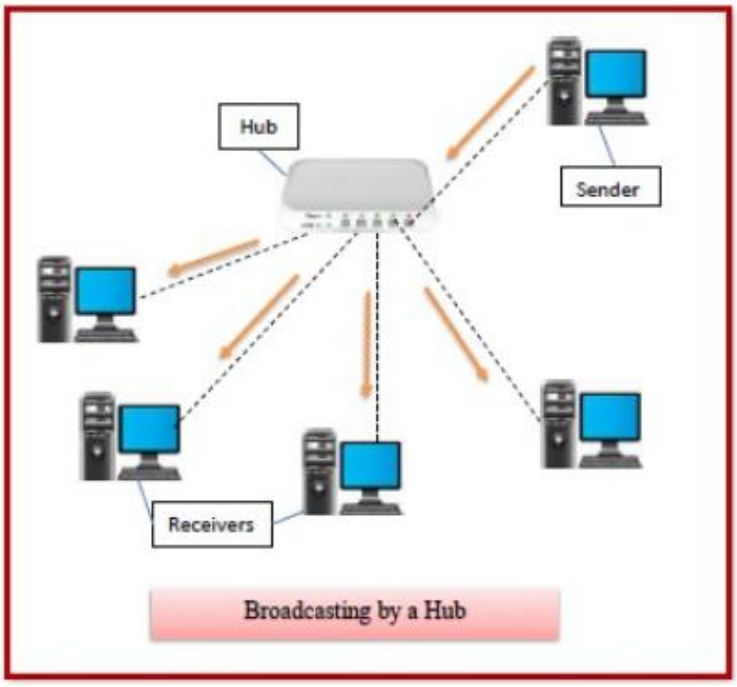


Fig: working of Hub

II. Switch:

Switches are networking devices operating at layer 2 or a data link layer of the OSI model. They connect devices in a network and use packet switching to send, receive or forward data packets or data frames over the network.

Working:
A switch has many ports, to which computers are plugged in. When a data frame arrives at any port of a network switch, it examines the destination address, performs necessary checks and sends the frame to the corresponding device(s). It supports unicast, multicast as well as broadcast communications.

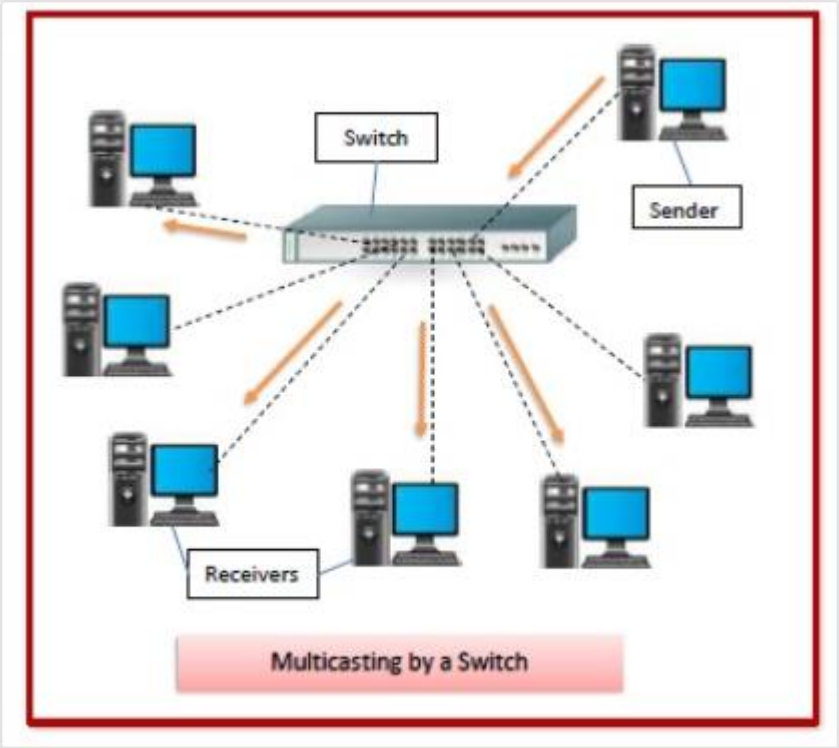


Fig: working of Switch

Features of Switches

- It is an intelligent network device that can be conceived as a multiport network bridge.
- It uses MAC addresses (addresses of medium access control sublayer) to send data packets to selected destination ports.
- It uses packet switching technique to receive and forward data packets from the source to the destination device.
- It is supports unicast (one-to-one), multicast (one-to-many) and broadcast (one-to-all) communications

III. Bridge:

Bridges are used to connect similar network segments.
It combines two LANs to form an extended LAN.

Working:

A bridge accepts all the packets and amplifies all of them to the other side. The bridges are intelligent devices that allow the passing of only selective packets from them. A bridge only passes those packets addressed from a node in one network to another node in the other network.

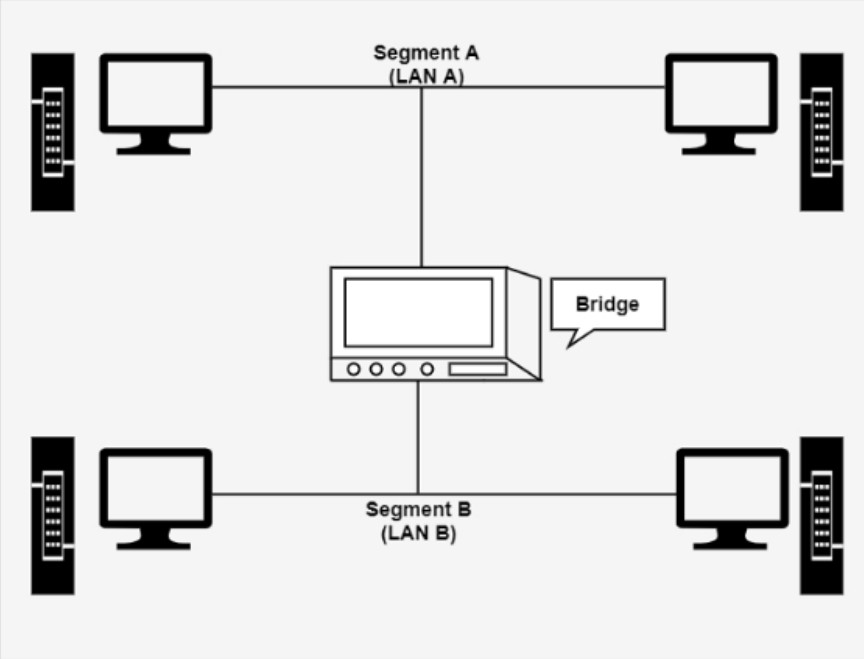
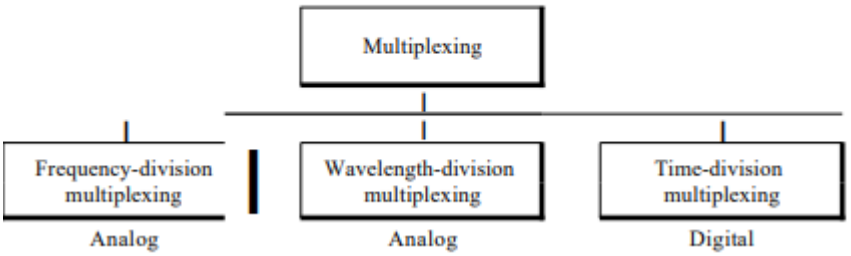


Figure – Bridge combines two LANs to form an extended LAN

	b)	**Describe the procedure to configure the TCP/IP network layer services.**	**6 M**
	Ans	Before beginning configuration procedure, the following are the prerequisites. • Network hardware is installed and cabled. • TCP/IP software is installed. To configure your TCP/IP network, the following steps are followed: 1) Read TCP/IP protocols for the basic organization of TCP/IP. 2) Minimally configure each host machine on the network. This means adding a network adapter, assigning an IP address, and assigning a host name to each host, as well as defining a default route to your network. For background information on these tasks, refer to TCP/IP network interfaces, TCP/IP addressing, and Naming hosts on your network. 3) Configure and start the intend daemon on each host machine on the network. Read TCP/IP daemons and then follow the instructions in Configuring the intend daemon. 4) Configure each host machine to perform either local name resolution or to use a name server. If a hierarchical Domain Name networks being set up, configure at least one host to function as a name server. 5) If the network needs to communicate with any remote networks, configure at least one host to function as a gateway. The gateway can use static routes or a routing daemon to perform internetwork routing.	Step by step procedure - 6M

		6) Decide which services each host machine on the network will use. By default, all services are available. Follow the instructions in Client network services if you wish to make a particular service unavailable. 7) Decide which hosts on the network will be servers, and which services a particular server will provide. Follow the instructions in Server network services to start the server daemons you wish to run. 8) Configure any remote print servers that are needed. 9) Optional: If desired, configure a host to use or to serve as the master time server for the network.	
	c)	**Explain multiplexing techniques.**	**6 M**
	Ans	Multiplexing is the set of techniques that allows the simultaneous transmission of multiple signals across a single data link. *Categories ofmultiplexing*  **Frequency-Division Multiplexing** Frequency-division multiplexing (FDM) is an analog technique that can be applied when the bandwidth of a link (in hertz) is greater than the combined bandwidths of the signals to be transmitted. In FOM, signals generated by each sending device modulate different carrier frequencies. These modulated signals are then combined into a single composite signal that can be transported by the link. Carrier frequencies are separated by sufficient bandwidth to accommodate the modulated signal. These bandwidth ranges are the channels through which the various signals travel. Channels can be separated by strips of unused bandwidth-guard bands-to prevent signals from overlapping. In addition, carrier frequencies must not interfere with the original data frequencies.	2 M for 3 multiplexing technique with diagram

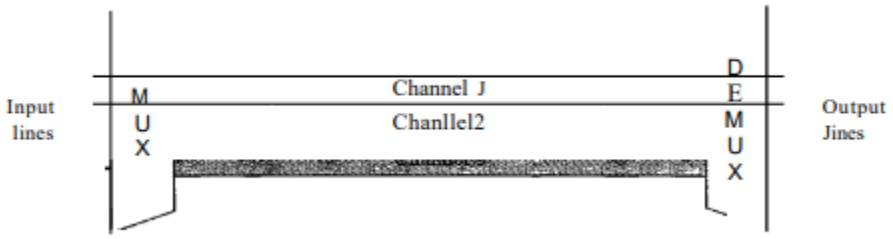


Fig: Frequency-Division Multiplexing

In above figure, the transmission path is divided into three parts, each representing a channel that carries one transmission.

Wavelength-Division Multiplexing

Wavelength-division multiplexing (WDM) is designed to use the high-data-rate capability of fiber-optic cable. The optical fiber data rate is higher than the data rate of metallic transmission cable. Using a fiber-optic cable for one single line wastes the available bandwidth. Multiplexing allows us to combine several lines into one.

WDM is conceptually the same as FDM, except that the multiplexing and de-multiplexing involve optical signals transmitted through fiber-optic channels. The idea is the same: We are combining different signals of different frequencies. The difference is that the frequencies are very high.

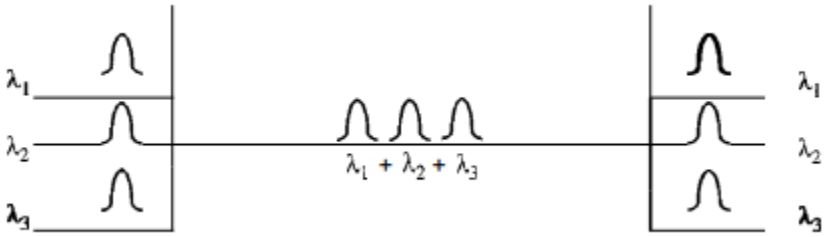
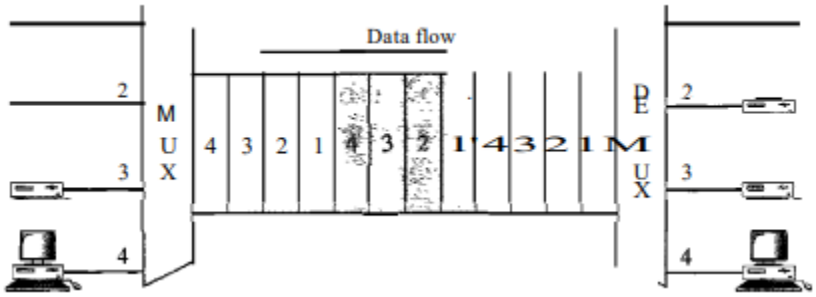


Fig: Wavelength-Division Multiplexing

Time-Division Multiplexing

Time-division multiplexing (TDM) is a digital process that allows several connections to share the high bandwidth of a linle Instead of sharing a portion of the bandwidth as in FDM, time is shared. Each connection occupies a portion of time in the link.

Figure gives a conceptual view of TDM. Note that the same link is used as in FDM; here, however, the link is shown sectioned by time rather than by frequency. In the figure, portions of signals 1,2,3, and 4 occupy the link sequentially.

		 Fig: Time-Division Multiplexing We also need to remember that TDM is, in principle, a digital multiplexing technique. Digital data from different sources are combined into one timeshared link. However, this does not mean that the sources cannot produce analog data; analog data can be sampled, changed to digital data, and then multiplexed by using TDM.	
6.		**Attempt any <u>TWO</u> of the following:**	**12 M**
	a)	**Explain the working of following topologies:** **1) Bus 2) Ring 3) Tree**	**6 M**
	Ans	**Bus Topology:** In networking, a topology that allows all network nodes to receive the same message through the network cable at the same time is called as bus topology. In this type of network topology, all the nodes of a network are connected to a common transmission medium having two endpoints. All the data that travels over the network is transmitted through a common transmission medium known as the bus or the backbone of the network. When the transmission medium has exactly two endpoints, the network topology is known by the name, 'linear bus topology'. A network that uses a bus topology is referred to as a “Bus Network”. **Working of Bus Topology:** Fig.shows bus topology. The central cable is the backbone of the network and is known as Bus (thus the name). Every workstation or node communicates with the other device through this Bus. A signal from the source is broadcasted and it travels to all workstations connected to bus cable. Although the message is broadcasted but only the intended recipient, whose MAC	2M each for each topology

address or IP address matches, accepts it.

If the MAC/IP address of machine does not match with the intended address, machine discards the signal. A terminator is added at ends of the central cable, to prevent bouncing of signals. A barrel connector can be used to extend it.

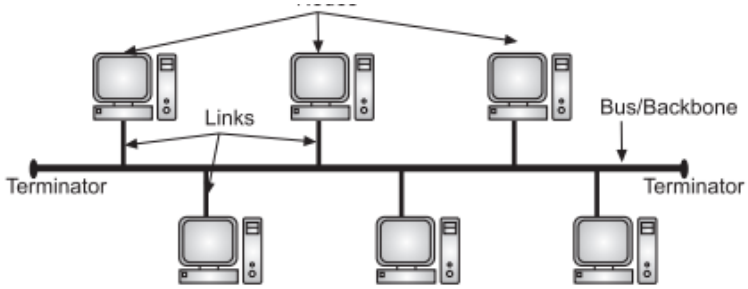


Fig: Bus Topology

II.Ring Topology:

Ring topology is a network topology that is set-up in circular fashion. It is called ring topology because it forms a ring as each computer is connected to another computer, with the last one connected to the first. Exactly two neighbors for each device.

Each node in this topology contains repeater. A signal passes node to node, until it reaches its destination. If a node receives a signal intended for another node its repeater regenerates the signal and passes it.

Token is a special three-byte frame that travels around the ring network. It can flow clockwise or anticlockwise. Ring topology is a point to point network.

The transmission is unidirectional, but it can be made bidirectional by having 2 connections between each network node, it is called Dual Ring Topology.

In dual ring topology, two ring networks are formed, and data flow is in opposite direction in them. Also, if one ring fails, the second ring can act as a backup, to keep the network up.

In a ring network, the data and the signals that pass over the network travel in a single direction. In ring topology network arrangement, a signal is transferred sequentially using a ‘token’ from one node to the next.

Fig. shows a ring topology. The token travels along the ring until it reaches its destination. Once, token reaches destination, receiving computer acknowledges receipt with a return message to the sender. The sender then releases the token for the token for use by another computer.

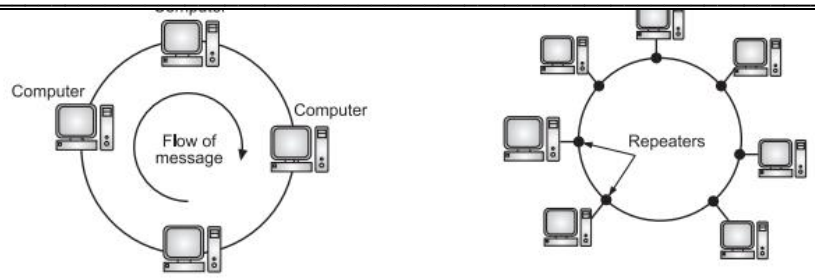


Fig: Ring Topology

Tree Topology:

As its name implies in this topology devices make a tree structure. Tree topology integrates the characteristics of star and bus topology.

• In tree topology, the number of star networks are connected using Bus. This main cable seems like a main stem of a tree, and other star networks as the branches.

• It is also called expanded star topology. Ethernet protocol is commonly used in this type of topology.

• Fig. shows tree topology. A tree topology can also combine characteristics of linear bus and star topologies. It consists of groups of star configure workstations connected to a linear bus backbone cable.

• Tree topologies allow for the expansion of an existing network and enable schools to configure a network to meet their needs.

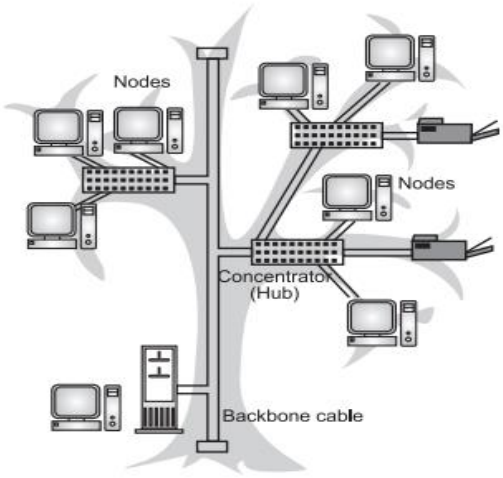
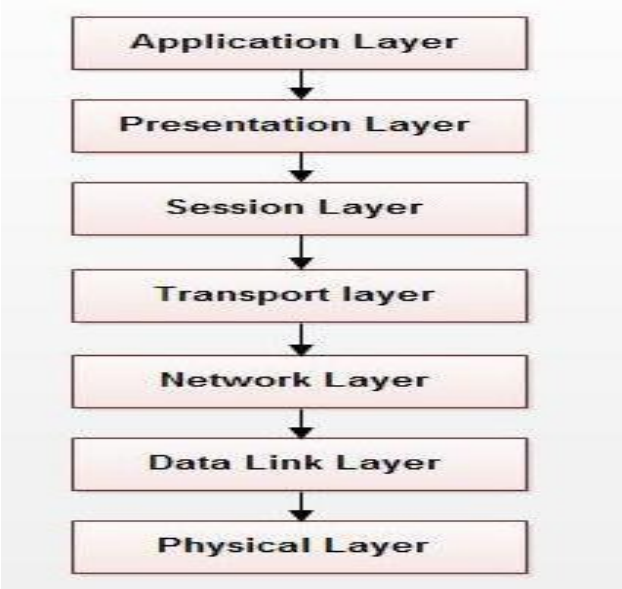


Fig: Tree Topology

	b)	**Explain the working of OSI model layers.**	**6 M**

	Ans	**Layered Architecture of ISO-OSI Model:** 1. The basic idea of a layered architecture is to divide the ISO-OSI model into small pieces. Each layer adds to the services provided by the lower layers in such a manner that the highest layer is provided a full set of services to manage communications and run the applications. 2. A basic principle is to ensure independence of layers by defining services provided by each layer to the next higher layer without defining how the services are to be performed. 3. In an n-layer architecture, layer n on one machine carries on conversation with the layer n on other machine. The rules and conventions used in this conversation are collectively known as the layer-n protocol.  **7 Layers of OSI reference Model** ISO-OSI model has 7 layered architectures. Functions of each layer are given below **Layer1: Physical Layer** 1. It activates, maintains and deactivates the physical connection. 2. It is responsible for transmission and reception of the unstructured raw data over network. 3. Voltages and data rates needed for transmission is defined in the physical layer. 4. It converts the digital/analog bits into electrical signal or optical signals. 5. Data encoding is also done in this layer.	1M for Diagram and 5M for explanation

Layer2: Data Link Layer

1. Data link layer synchronizes the information which is to be transmitted over the physical layer.

2. The main function of this layer is to make sure data transfer is error free from one node to another, over the physical layer.

3. Transmitting and receiving data frames sequentially is managed by this layer.

4. This layer sends and expects acknowledgements for frames received and sent respectively. Resending of no acknowledgement received frames is also handled by this layer.

Layer3: The Network Layer

1. Network Layer routes the signal through different channels from one node to other.

2. It acts as a network controller. It manages the Subnet traffic.

3. It decides by which route data should take.

4. It divides the outgoing messages into packets and assembles the incoming packets into messages for higher levels.

Layer 4: Transport Layer

1. Transport Layer decides if data transmission should be on parallel path or single path.

2. Functions such as Multiplexing, Segmenting or Splitting on the data are done by this layer

3. It receives messages from the Session layer above it, converts the message into smaller units and passes it on to the Network layer.

4. Transport layer can be very complex, depending upon the network requirements.

Transport layer breaks the message (data) into small units so that they are handled more efficiently by the network layer.

Layer 5: The Session Layer

1. Session Layer manages and synchronizes the conversation between two different applications.

2. Transfer of data from source to destination session layer streams of data are marked and are resynchronized properly, so that the ends of the messages are not cut prematurely and data loss is avoided.

Layer 6: The Presentation Layer

1. Presentation Layer takes care that the data is sent in such a way that the receiver will understand the information (data) and will be able to use the data.

2. While receiving the data, presentation layer transforms the data to be ready for the application layer.

3. Languages(syntax) can be different of the two communicating systems. Under this condition presentation layer plays a role of translator.

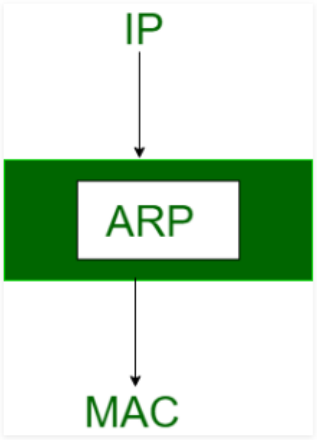
4. It performs Data compression, Data encryption, Data conversion etc.

Layer 7: Application Layer

1. Application Layer is the topmost layer.

2. Transferring of files disturbing the results to the user is also done in this layer. Mail services, directory services, network resource etc are services provided by application layer.

3. This layer mainly holds application programs to act upon the received and to be sent data.

	c)	**Explain ARP, subnetting and supernetting with example.**	**6 M**
	Ans	**ARP:** Most of the computer programs/applications use **logical address (IP address)** to send/receive messages, however, the actual communication happens over the **physical address (MAC address)** i.e from layer 2 of the OSI model. So our mission is to get the destination MAC address which helps in communicating with other devices. This is where ARP comes into the picture, its functionality is to translate IP address to physical addresses.  ARP finds the hardware address, also known as Media Access Control (MAC) address, of a host from its known IP address. It is responsible to find the hardware address of a host from a know IP address there are three basic ARP terms.	2M each for ARP, subnetting and supernetting with example

The important terms associated with ARP are:
(i) Reverse ARP
(ii) Proxy ARP
(iii) Inverse ARP

Subnetting:

Dividing the network into smaller contiguous networks or subnets is called subnetting. Suppose we take a network of class A. So, in class A, we have 2^{24} hosts. So to manage such a large number of hosts is tedious. So if we divide this large network into the smaller network then maintaining each network would be easy.

Suppose we have a class C network having network ID as 201.10.1.0(range of class C 192–223). So the total number of hosts is 256(for class C host is defined by last octet i.e. 2^8). But, the total usable host is 254. This is because the first IP address is for the network ID and the last IP address is Direct Broadcast Address (for sending any packet from one network to all other hosts of another network).

So, in subnetting we will divide these 254 hosts logically into two networks. In the above class C network, we have 24 bits for Network ID and the last 8 bits for the Host ID.

Supernetting:

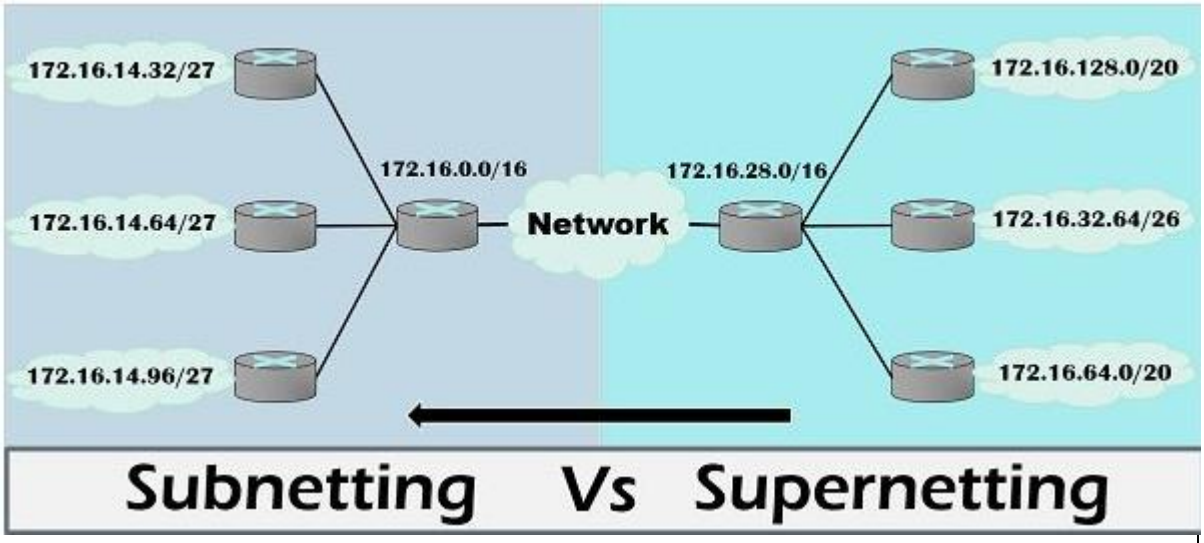
Supernetting is the opposite of Subnetting. In subnetting, a single big network is divided into multiple smaller subnetworks. In Supernetting, multiple networks are combined into a bigger network termed as a Supernetwork or Supernet.
Supernetting is mainly used in Route Summarization, where routes to multiple networks with similar network prefixes are combined into a single routing entry, with the routing entry pointing to a Super network, encompassing all the networks. This in turn significantly reduces the size of routing tables and also the size of routing updates exchanged by routing protocols.

More specifically, when multiple networks are combined to form a bigger network, it is termed as **super-netting**

Super netting is used in route aggregation to reduce the size of routing tables and routing table updates
There are some points which should be kept in mind while supernetting:

All the IP address should be contiguous.
Size of all the small networks should be equal and must be in form of 2n.
First IP address should be exactly divisible by whole size of supernet.

For example:


172.16.14.32/27
172.16.14.64/27
172.16.14.96/27
172.16.0.0/16
Network
172.16.28.0/16
172.16.128.0/20
172.16.32.64/26
172.16.64.0/20
Subnetting Vs Supernetting