WINTER– 18 EXAMINATION

Subject Name: Computer Network **Model Answer** Subject Code: 17429

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.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1		**Solve any 10 :**	**20 M**
	1	**Write any two characteristics of LAN.**	2 M
	Ans	**Characteristics of LAN:** • LAN (local area network) is a computer network covering a small geographical area, like a home, office, school or a group of buildings. • It is usually a privately owned computer network. • It is a network within a single building or campus of up to a few kilometers in size. (1 to 10Km) • Bandwidth of LAN is low when compared to WAN. • Transmission media can be any guided media. • LAN supports speed upto 1000Mbps.	Any two – each 1M
	2	**Define packet.**	2 M
	Ans	**Packet :** A packet is the unit of data that is routed between source network and destination network on any packet-switched network.	Correct Definition - 2M;

		A packet contains a source address, destination address, data, size, and other useful information that helps packet make it to the appropriate location and get reassembled properly.	
	3	**Define network topology.**	2 M
	Ans	**Network Topology:** A network topology is the arrangement of a *network*, including its nodes and connecting lines. It is the structure of a network including physical arrangement of devices.	Any relevant definition – 2M
	4	**State two Advantages of star topology.**	2 M
	Ans	**Advantages of star topology:** • Centralized management allows better monitoring the network • Easy to manage as connection of nodes and removing can be done easily, without affecting the network. • Failure of one link doesn't affect the rest of the network. • Easy to detect the failure and troubleshoot. • Better performance as the signal sent by the node doesn't necessarily get transmitted to all workstations.	Any two advantages - each 1M
	5	**What is modem?**	2 M
	Ans	**Modem :** A modem, which stands for modulator-demodulator, is the device used to translate analog signals into digital signals or vice versa for purposes of computer communications.	Full form – 1M Definition – 1M
	6	**Identify switches and state in which layer of OSI reference model they operate.**	2 M
	Ans	**Switch :** Switches are network devices used to connect multiple computers in which it can direct a transmission to its specific destination. (Unicast the signals). There are two types of switches namely, Layer-2 and layer-3 switches. They can be used to connect single or multiple networks. Layer 2 Switches operate in the data link layer (layer 2) using the MAC addresses. Layer 3 Switches operate in the network layer (layer 3) using the IP address.	Definition – 1M Identification of layer – 1M
	7	**State two applications of microwave communications.**	2 M
	Ans	**Applications of microwave communications:** • Microwaves sue to their unidirectional properties are useful when one to one communication is needed between sender and receiver.	Any Two applications – each 1M

- They are used in cell phones
- Microwaves are used in satellite communication.
- Wireless LANs make use of microwave communications.
- Remote Sensing Radar microwave radiations to detect range, speed and other characteristics of remote object.

	8	**Enlist any four communication bands for unguided media with their frequency range.**	2 M
	Ans	**Communication bands for unguided media:**	Any four bands – each ½ M

Band	*Range*
VLF (very low frequency)	3-30 kHz
LF (low frequency)	30-300 kHz
MF (middle frequency)	300 kHz-3 MHz
HF (high frequency)	3-30 MHz
VHF (very high frequency)	30-300 MHz
UHF (ultrahigh frequency)	300 MHz-3 GHz
SHF (superhigh frequency)	3-30 GHz
EHF (extremely high frequency)	30-300 GHz

	9	**State two disadvantages of optical fiber**	2 M
	Ans	**Disadvantages of optical fiber:**	Any 2 disadvantages – each 1M

- Installation and maintenance: Fiber optic cable's installation and maintenance require expertise.
- Unidirectional light propagation: Propagation of light is unidirectional. For bidirectional communications, two fibers are needed.

		• Cost: The cable and the interfaces are relatively more expensive than those of other guided media.	
	10	**Define Wi-Fi.**	2 M
	Ans	**Wi-Fi :** Commonly termed as Wireless Fidelity, Wi-fi is a facility allowing computers, smartphones, or other devices to connect to the Internet or communicate with one another wirelessly within a particular area. Generally IEEE 802.11x standard is referred as Wi-fi for wireless communications.	Any other relevant meaningful definition – 2M
	11	**Define protocol.**	2 M
	Ans	**Protocol :** Protocol is defines as the set of rules and regulations to communicate between layers in networking.	Any other relevant definition – 2M
	12	**Enlist layers of OSI reference model.**	2 M
	Ans	**OSI reference model layers:** 1. Application Layer 2. Presentation Layer 3. Session layer 4. Transport layer 5. Network layer 6. Data link layer **7.** Physical Layer	Correct list – 2M

OSI reference model :

Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Datalink Layer
Physical Layer

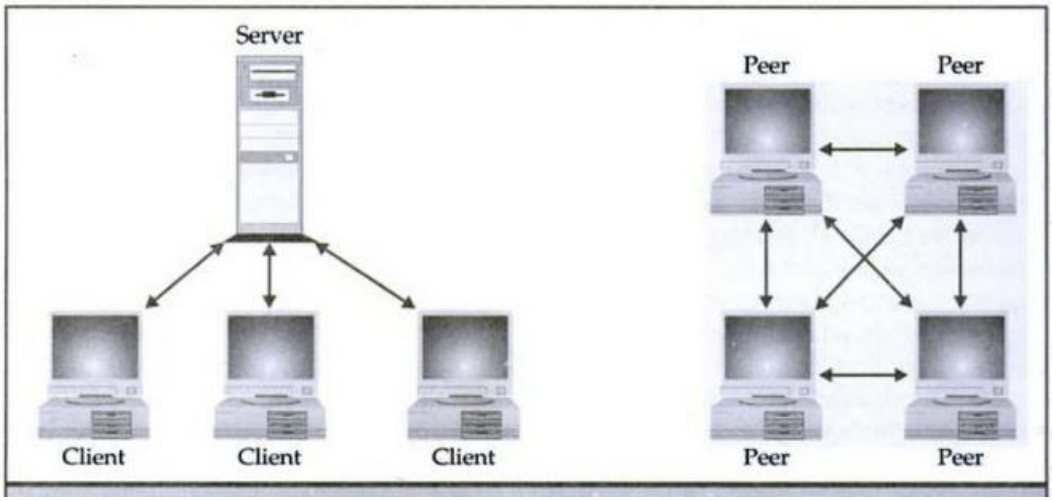
Fig: OSI Reference model.

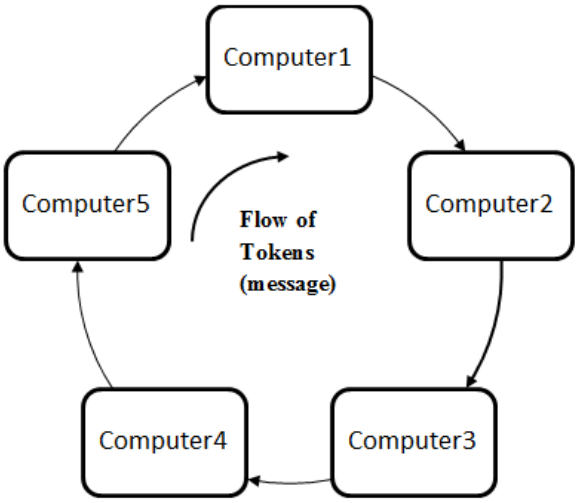
	13	**What is subnet masking?**	2 M
	Ans	**Subnet Masking:** Subnet masking is used to identify/separate network address (including subnets) and host address. A Subnet mask is a 32-bit number that masks an IP address, and divides the IP address into network address and host address.	Any other relevant definition – 2M
	14	**States IP address classes.**	2 M
	Ans	**IP address classes:** IP (or IPv4) has 5 classes namely; Class A, Class B, Class C, Class D, Class E. These classes are identified with the following range:	**Correct classes – 2M**

Class	Most significant bits	First Octet (decimal number) Range	Start Address	End Address
Class A	0	1 to 126	1.0.0.0	126.255.255.255
Class B	10	8 to 191	128.0.0.0	191.255.255.255
Class C	110	192 to 223	192.0.0.0.	223.255.255.255
Class D	1110	224 to 239	224.0.0.0	239.255.255.255
Class E	11110	240 to 255	240.0.0.0	255.255.255.255

2		**Solve any FOUR :**	**16 M**

	a	**Explain classification of computer network.**	4 M
	Ans	**Note: Classification based on any other criteria shall also be considered.** **Classification of Computer network** Classification of networks based on geography **LAN** - Local Area Network **MAN** - Metropolitan Area Network **WAN** - Wide Area Network **CAN** - Campus Area Network **PAN** - Personal Area Network **PAN:** 1. A PAN is personal area network is used for communication among computer devices close to one's person. 2. Wireless networking or Bluetooth technologies are the some examples of PAN. The communication network established for the purpose of connecting computer devices of personal use is known as the PAN. **CAN:** 1. CAN is a Campus Area Network is used to connect buildings across campuses of colleges or Universities. 2. A CAN is actually a type of LAN. 3. It is larger than a LAN but smaller than MAN. CAN is a network that connects two or more LANs but that is limited to a specific and contiguous geographical area such as a college campus, industrial complex or military base. **LAN:** 1. LAN is local area network. LAN is privately-owned networks covering a small geographic area(less than 1 km), like a home, office, building or group of buildings. 2. LAN transmits data with a speed of several megabits per second. **MAN:** 1. A Metropolitan Area Network (MAN) is a large computer network that spans a metropolitan area or campus. 2. A MAN typically covers an area up to 10 kms (city). The best example of MAN is the cable Television network, available in many cities. 3. For an organization, the common use of a MAN is to extend their LAN connectivity between buildings/offices that are within the same city or urban area (hence the name Metropolitan Area Network). 4. The organization can pass their Ethernet frames to the service provider MAN; the service provider will carry their frames across the MAN; and then deliver the frames to the destination site. 5. From the customer's point of view, the MAN looks like one big (long) Ethernet link between their offices. 6. The different sites could belong to the same IP subnet, and from the customer's viewpoint, no routing is required between their sites. **WAN:** 1. WAN is wide area network. 2. WAN is a long-distance communication network that covers a wide geographic area, such as state or country. 3. The most common example is internet.	List – 1M; Explanation -3M

		4. A WAN provides long-distance transmission of data, voice, image and video information over larger geographical areas that may comprise a country or even whole world. **OR** Classification of computer networks based on network relationships: i) Client Server network ii) Peer to peer network **Client Server Network:** In this network, a centralized computer, server is used for sharing the resources and providing services to other computers, clients. Thus the name Client Server. The servers stores all the network's shared files and applications programs, such as word processor documents, compilers, database applications, spreadsheets, and the network operating system. Client will send request to access information from the server. Based on the request, server will send the required information to the client.  **Figure showing Client server network and peer to peer network** Peer to peer network: In this type of network, each computer/node shares its resources using its own file system. There are no servers required in this network. Thus there is no centralized management, but each system owns its resources and services to be shared with other computers.	
	b	**Explain Benefits of computer network.**	4 M
	Ans	**Benefits of computer network:** **File sharing: C**omputer networks allow file sharing and remote file access. A person sitting at one workstation connected to a network can easily see files present on another workstation, provided he/she is authorized to do so. **Resource Sharing:** A computer network provides a cheaper alternative by the provision of resource sharing. All the computers can be interconnected using a network and just one modem & printer can efficiently provide the services to all users. **Inexpensive set-up:** Shared resources means reduction in hardware costs. Shared files means reduction in memory requirement, which indirectly means reduction in file storage	Any other 4 relevant benefits – each 1M

		expenses. **Flexible Handling:** A user can log on to a computer anywhere on the network and access his/her files. This offers flexibility to the user as to where he/she should be during the course of his/her routine. **Centralized Management-** Networking allows the management of various resources in the organization, centrally through architectures such as client server architecture. **Backing up data:** Creating backup files and restoring them becomes much easier using computer networks. **E-mail Services** : E-mail is extremely valuable & important feature for communication within organization or outside the people in world. Networking allows file based or client based systems for communication.	
	c	**Explain the working of ring topology with neat sketch.**	4 M
	Ans	**Ring topology:** In a ring topology, each computer or node is connected to the next node and the last computer is connected to the first computer as shown in the diagram below.  Thus, each computer has a dedicated point to point connection with only the two computers on either side of it. A signal is passed along the ring in one direction, from computer to computer, until it reaches its destination. In ring topology, each computer on the ring receives the data unit from the previous computer, regenerates it, and forwards it to the next computer. **Working**: Every computer on the ring is responsible for passing the token or creating a new one. When a computer has information to send, it creates the token and passes it on. Once the token reaches its final destination, it lets the sender know it arrived safely; the sender then makes a new token and the process starts over. Most ring networks use fiber or twisted pair cable for their physical medium.	Definition - 1M Diagram – 1M Explanation -2M

		In a ring topology, if one computer fails, the entire network goes down.	
	d	**Describe the Characteristics of satellite microwave transmission**	4 M
	Ans	**Characteristics of satellite microwave transmission** • In satellite communication, signal transferring between the sender and receiver is done with the help of satellite. • In this communication, electromagnetic waves are used as carrier signals. These signals carry the information such as voice, audio, video or any other data between ground and space and vice-versa. • The transmission of signal from first earth station to satellite through a channel is called as uplink. The frequency with which, the signal is sent into the space is called as Uplink frequency (6Hz). • The satellite transponder converts this signal into another frequency and sends it down to the second earth station. A transponder is used to increase the strength of the received signal and change the frequency band of the transmitted signal from the received one. • The transmission of signal from satellite to second earth station through a channel is called as downlink. The frequency with which, the signal is sent by the transponder is called as Downlink frequency (4GHz). • There are three methods of communication using satellites using three modulation techniques as FDMA, TDMA and CDMA. • 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. Therefore Geosynchronous satellites are used which move at same RPM as that of the earth in the same direction.	Any four characteristics – 1M each
	e	**Describe the Functions of presentation layer.**	4 M
	Ans	**Functions of presentation layer :** • Presentation layer is concerned with the syntax and semantics of the information transmitted. • Requesting the opening, closing and implementation of a session. • Performing data exchange • Coordination of syntax and presentation profile • Syntax translation for character set, text strings, data display formats, graphics, file and data types. **OR** • The presentation layer works to transform data into the form that the application layer can accept. • **Translation:** presentation layer is responsible for converting various formats into required format of the recipient. • **Encryption:** Data encryption and decryption is done by presentation layer for security.	Any Four functions – 1M each

- **Compression and Decompression:** To increase the speed of transmission, data is compressed while sending and decompressed while receiving.
- Presentation layer is concerned with syntax, semantics of information exchanged between the two systems.

f **Compare TCP and UDP.** 4 M

Ans **TCP and UDP comparison** Any four correct comparisons – 1M each

Characteristics	**TCP**	**UDP**
Connection	TCP is connection oriented Protocol	UDP is connection less Protocol
Reliability	It provides reliable delivery of messages	It provides unreliable delivery of messages
Error Handling	TCP makes checks for errors and reporting	UDP does error checking but no reporting.
Flow controlling	TCP has flow control	UDP has no flow control
Data transmission order	TCP gives guarantee that the order of the data at the receiving end is the same as the sending end	No guarantee of the data transmission order
Header Size	20 bytes	8 bytes
Acknowledgment	TCP acknowledges the data reception	UDP has no acknowledgment Section
Application	Used where reliability is important	Used where time sensitivity is more important.

3 **Solve any FOUR :** **16 M**

a **Describe features of application server and mail servers.** 4 M

Ans **Definition of server:** The central computer which is more powerful than the clients & which allows the clients to access its software & database is called as the server. 2 Marks each

Types of server:
1. File server
2. Print server
3. Application server
4. Mail server

Application server:
- The expensive software & additional computing power can be shared by the computers in a network with the help of application servers.
- The application servers provide security & efficiency.
- It also provide software application with servers such as security, data services, transaction support, load balancing, & management of large distributed system.
- To perform above tasks, application server must have high configuration.
- Examples: SUN Java application server, weblogic server

Mail servers:
- A mail server (sometimes also referred to an e-mail server) is a server that handles and delivers e-mail over a network, usually over the Internet.

- A mail server can receive e-mails from client computers and deliver them to other mail servers.
- A mail server can also deliver e-mails to client.
- Examples: Yahoo, Gmail, Rediffmail etc.

b **Compare Hub and Switch.** 4 M

Ans Any 4 correct comparision: 1 Mark each

HUB	SWITCH
To connect a network of personal computers together, they can be joined through a central hub.	To connect multiple computers in which it can direct a transmission to its specific destination.
It is the broadcasting device.	It is a unicasting device.
There are three different types of hubs: active hub, passive hub and intelligent hub.	There are two different types of switches: cut-through switch, store-and-forward switch.
It is the passive device.	It is the active device.
It works at Physical layer of OSI reference model.	It works at Data link layer of OSI reference model.
It creates unnecessary network traffic.	It avoids unnecessary network traffic.

c **Explain the bands in cellular telephony.** 4 M

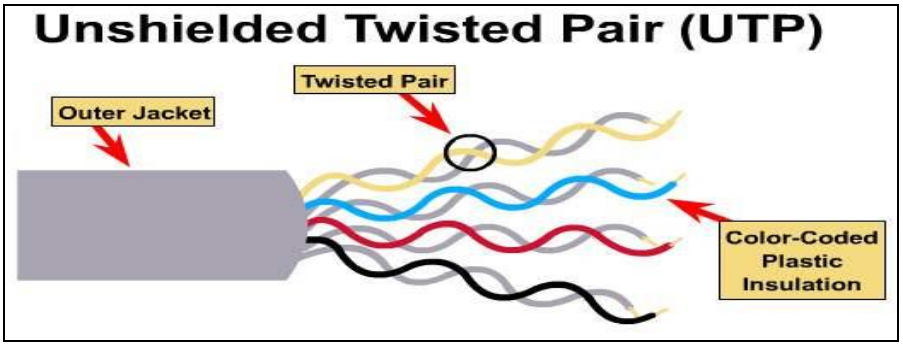
Ans 4 Marks relevant explanation

Cellular telephony uses Analog transmission. Frequency modulation is used for communication between the mobile phone and the cell office. Two frequency bands are allocated for this purpose:

i. Communication that is initiated by the mobile phone.
ii. Communication that is initiated by landline phone.

- Full duplex operation is possible by separating transmit and receive signals into separate frequency bands.
- Cellular phone units transmit in the lower band of frequencies, 825 to 845 MHz, and receive in the higher band, 870 to 890 MHz
- Within these two bands, 666 separate channels (333 channels per band) have been assigned for voice and control.
- Each channel requires a full-duplex dialog.
- For preventing interference, adjacent channels are rarely allocated.
- Some channels are also required for control purpose.
- This reduces the number of channels available for the cell.
- Each channel occupies a bandwidth of 30 kHz.

d **Draw and explain unshielded twisted pair cable.** 4 M

	Ans	**Unshielded Twisted Pair Cable (UTP)** Unshielded twisted pair is the most common kind of copper telephone wiring. Twisted pair is the ordinary copper wire that connects home and many business computers to the telephone company. To reduce crosstalk or electromagnetic induction between pairs of wires, two insulated copper wires are twisted around each other. Each signal on twisted pair requires both wires.  • **Connectors:** i. The most common UTP connector is RJ45 (RJ stands for Registered Jack). ii. The RJ45 is a keyed connector (the connector can be inserted in only one way). • **Application:** 1. Local Area Networks, such as 10Base-T and 100Base-T, use twisted pair cable. 2. The most common application of the twisted pair is also the telephone system.	Labelled Diagram:2 Marks, Explanation: 2 marks
	e	**Explain data link layer in details.**	4 M
	Ans	**Data link layer**: Data link layer is the second layer of the OSI model. It accepts the data from the Network layer, attaches header & trailer and send it to the physical layer. At receives side it accepts the data from the physical layer snip of header & footer & gives back to network layer the way it has taken. **Working:** • It is responsible for transmitting group of bits between the adjacent nodes. • The group of bits is called as frame. • The data link in a network model layer transforms the physical layer, a raw transmission facility, to a reliable link. • It makes the physical layer appear error-free to the upper layer (network layer). • Figure shows the relationship of the data link layer to the network and physical layers of network model.	

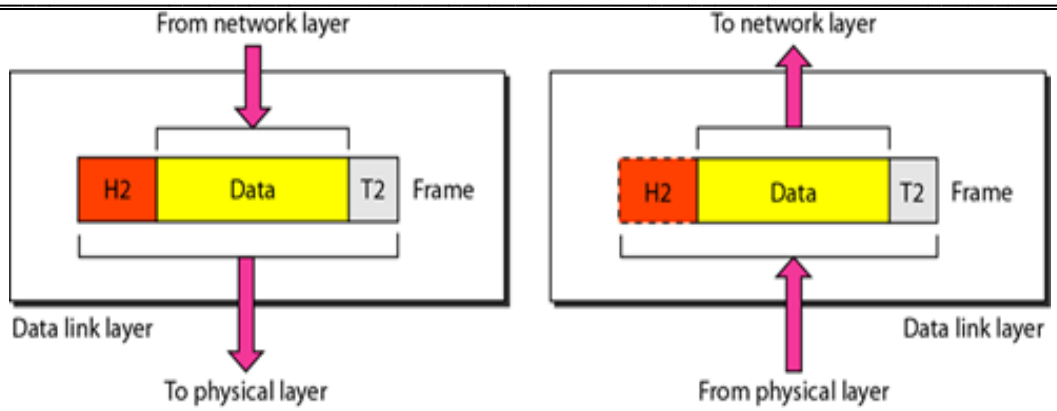


Figure: Data link layer in a network model

- The data link layer in a network model is responsible for moving frames from one hop (node) to the next.
- Other responsibilities of the data link layer in a network model include the following:

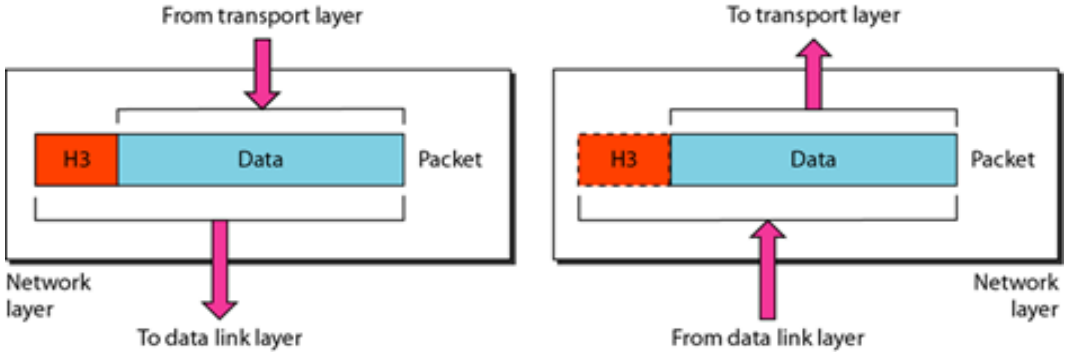
1. **Framing.**
   The data link layer in a network model divides the stream of bits received from the network layer into manageable data units called frames.
2. **Physical addressing.**
   If frames are to be distributed to different systems on the network model, the data link layer in network model adds a header to the frame to define the sender and/or receiver of the frame. If the frame is intended for a system outside the sender's network, the receiver address is the address of the device that connects the network to the next one.
3. **Flow control.**
   If the rate at which the data are absorbed by the receiver is less than the rate at which data are produced in the sender, the data link layer in network model imposes a flow control mechanism to avoid overwhelming the receiver.
4. **Error control**.
   The data link in network model layer adds reliability to the physical layer by adding mechanisms to detect and retransmit damaged or lost frames. It also uses a mechanism to recognize duplicate frames. Error control is normally achieved through a trailer added to the end of the frame.
5. **Access Control.**
   When two or more devices are connected to the same link, data link layer protocols in network model are necessary to determine which device has control over the link at any given time.

	f	**Compare IPv4 and IPv6.**	4 M

	Ans		Any 4 correct points:1 Mark each

IPV6	IPV4
Source and destination addresses are 128 bits (16 bytes) in length. For more information.	Source and destination addresses are 32 bits (4 bytes) in length.
There are no IPv6 broadcast addresses. Instead, multicast scoped addresses are used.	Uses broadcast addresses to send traffic to all nodes on a subnet.
Fragmentation is not supported at routers. It is only supported at the originating host.	Fragmentation is supported at originating hosts and intermediate routers.
IP header does not include a checksum.	IP header includes a checksum.
All optional data is moved to IPv6 extension headers.	IP header includes options.
IPSec support is required in a full IPv6 implementation.	IPSec support is optional.
Payload identification for **QOS** handling by routers is included in the IPv6 header using the Flow Label field...	No identification of payload for **QOS** handling by routers is present within the IPv4 header.
Addresses can be automatically assigned using stateless address auto configuration, assigned using DHCPv6, or manually configured.	Addresses must be configured either manually or through DHCP.
Uses host address (**AAAA**) resource records in the Domain Name System (DNS) to map host names to IPv6 addresses.	Uses host address (**A**) resource records in the Domain Name System (DNS) to map host names to IPv4 addresses.

4		**Solve any FOUR :**	**16 M**
	a	**State any 4 advantages of peer to peer network over client/server network.**	4 M
	Ans	Following are the advantages of peer to peer network over client/server network: • Easy to setup and lower cost for small network. • No extra investment in server hardware or software is required. • The efforts of administrating the network are widely distributed among users. • Peer to peer network do not require a network operating system. • Users can control resource sharing.	any 4 points:1 mark each
	b	**State whether bus is active or passive network. Justify.**	4 M
	Ans	Bus is a passive network. In the bus topology the major component is the backbone cable. The communication takes place through it and this backbone does not do any amplification or correction of signals or port identification. It simply broadcast signal that's why bus can be called as passive	Passive network: 1 mark, Justification:

		network**.**	3 marks
	c	**Describe light source for fiber**.	4 M
	Ans	A Fiber-Optic Cable (FOC) is made of glass or plastic and transmits signals in the form of light. Light sources used for FOC are of two types: i) LED (Light Emitting Diodes) ii) Semiconductor Laser. The LED is low cost. It provides an unfocussed light which hits the core boundaries and gets diffused. LED is preferred only for short distance. It has low data rate. The laser diode can provide a much focused beam which can be used for a long distance communication. It has high data rate. It is very expensive.	Listing 1 mark, 3 marks for description
	d	**Explain network layer in details.**	4 M
	Ans	**Network layer:** • The network layer in a network model is responsible for the source-to-destination delivery of a packet, possibly across multiple network models (links). • The network layer in a network model ensures that each packet gets from its point of origin to its final destination. • If two systems are connected to the same link, there is usually no need for a network layer in a network model. • However, if the two systems are attached to different network models (links) with connecting devices between the network models (links), there is often a need for the network layer in network model to accomplish source-to-destination delivery. • Following Figure shows the relationship of the network layer to the data link and transport layers in a network model.  **Figure: Network layer in a network model** • The network layer in a network model is responsible for the delivery of individual packets from the source host to the destination host. • Other responsibilities of the network layer in a network model include the following: **1. Logical addressing:** The physical addressing implemented by the data link layer handles the addressing problem locally. If a packet passes the network boundary, we need another addressing system to help distinguish the source and destination systems.	working :2 Marks, Functions: 2 marks

The network layer in network model adds a header to the packet coming from the upper layer that, among other things, includes the logical addresses of the sender and receiver.

2. **Routing:**

When independent network models or links are connected to create internetworks (network of networks) or a large network model, the connecting devices (called routers or switches) route or switch the packets to their final destination. One of the functions of the network layer in network model is to provide this mechanism.

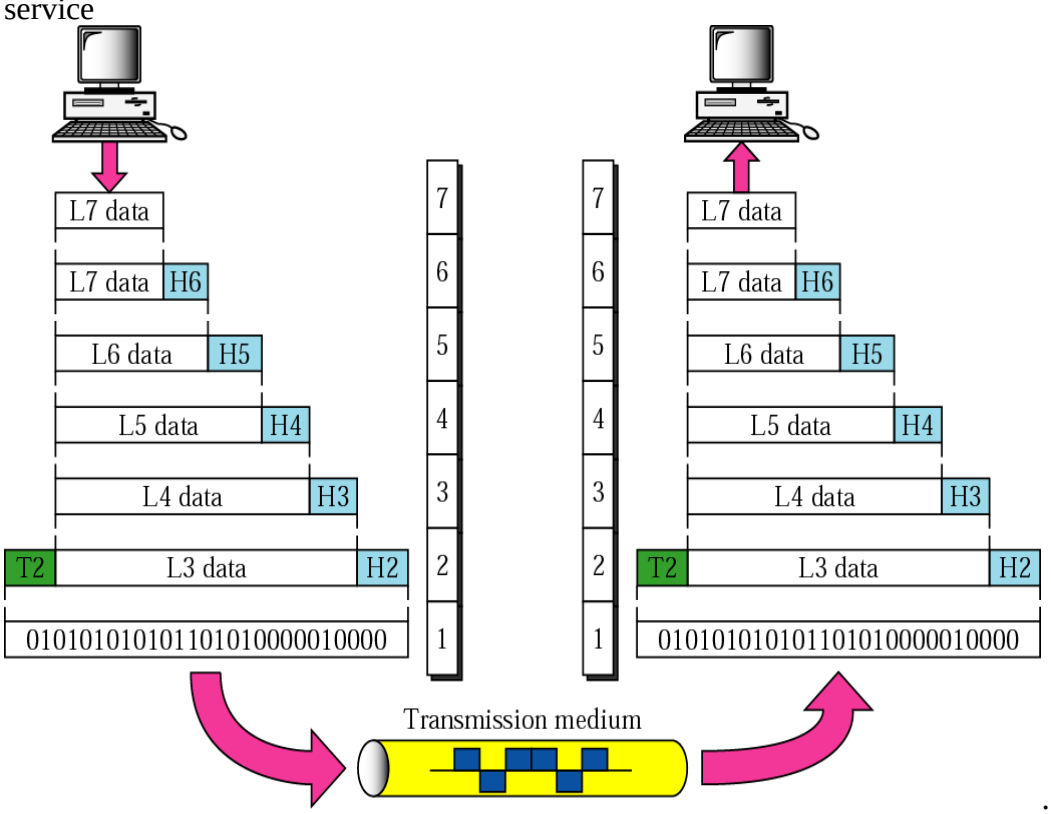
e **Explain the concept of data encapsulation.** 4 M

Ans

- In computer networking, the term encapsulation is used to refer to the process of each layer at the sending computer adding its own header information, in the form of meta-data to the actual payload (data)
- To satisfy all the requirements, the protocols operating at the various layers work together to supply a unified quality of service

Diagram 2 Marks,

Explanation :2 Marks



- In a typical transaction, an application layer protocol (which includes presentation and session layer functions) generates a message that is passed down to a transport layer protocol.
- The protocol at the transport layer has its own packet structure, which is known as a protocol data unit (PDU).
- PDU includes specialized header field and a data field that carries the payload.
- The payload is the data received from the application layer protocol.
- The transport layer encapsulates the application layer data and then passes it down to the next layer.
- The network layer protocol then receives the PDU from the transport layer and

encapsulates it within its own PDU by adding a header and using the entire transport layer PDU as its Payload.

- The same process occurs again when the network layer passes its PDU to the data link layer, which adds a header and footer.
- Once it is encapsulated by the data link protocol, the complete packet is then ready to be converted to the appropriate type of signal used by the network medium.
- The final packet consists of original application layer data plus several headers added by the protocol at the succeeding layers.

f **Explain structure of IP frame header.** 4 M

Ans **IPv4 header:** The IP datagram contains header and data. The header consists of around 20 to 60bytes consists of information about routing and delivery. The header is like an envelope i.e., it contains information about the data. The structure of the standard format is as shown below.

Diagram 2 Marks,

Explanation :2 Marks

**Note: Any relevant Diagram and explanation can be considered.

Version (4 Bits)	HLEN (4 bits)	Service Type (ToS) (8 Bits)	Total Length (16 bits)	
Identification (16 bits)			Flags (3bits)	Fragmentation offset (13 bits)
Time to Live (TTL) (8 bits)		Protocol (8 bits)	Header Checksum (16 bits)	
Source IP address (32 bits)				
Destination IP address (32 bits)				

The various fields are as described below:

Version: This field identifies the version of IP, which contains a value 4, which indicates IP version 4. It may contain 6 for IPv6

Header length (HLEN): This indicates the size of the header in a multiple of 4 byte words. When the header size is 20 bytes, HLEN = 5, and HLEN = 15 when maximum size (60 bytes).

Service Type (Type of Service): This field is used to define service parameters such as the priority of the datagram and the level of reliability desired.

Total Length: This field contains the total length of the IP datagram. IP datagram cannot be more than 65,536 since this filed size is 2 bytes or 16 (216 = 65,536).

Identification: This field is used in the situations when a datagram is fragmented. The sub datagram are sequenced using identification field so that later it can be used to reconstruct the original datagram.

Flags: This field corresponds to identification field. It indicates whether a datagram can be fragmented and if fragmented, the position of the fragment (first, last or middle).

Fragmentation Offset: If a datagram is fragmented, this field indicates the offset of the data in the original datagram before segmentation. This is used while reconstructing.

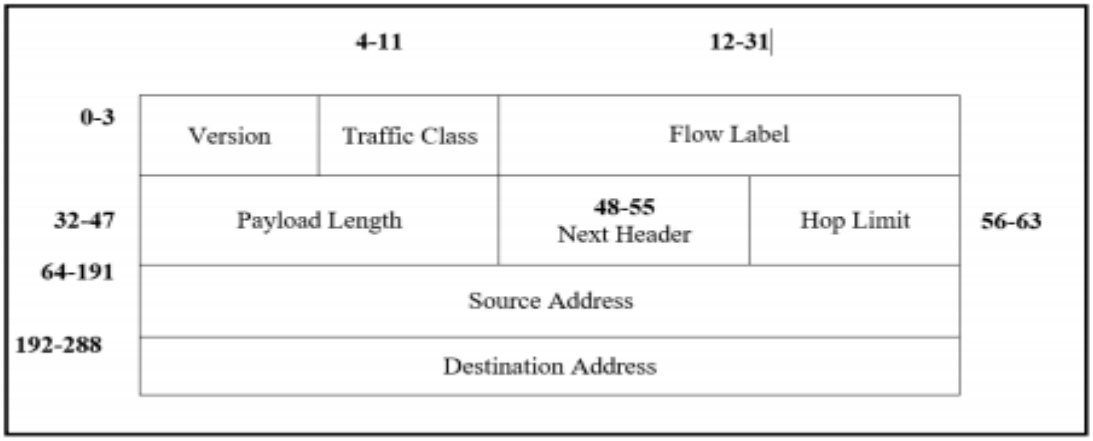
Time to Live (TTL): This filed is initialized by some value and decremented each time it passes through routers. If the value becomes zero or negative, the data is not forwarded. Thus it decides the lifetime of the data.

Protocol: This field identifies the transport protocol running on top of IP. The upper layer software piece can be TCP or UDP. This field specifies which piece of software at the

destination node the datagram should be passed on to.
Source address: This field contains the 32 bit IP address of the sender.
Destination address: This field contains the 32 bit IP address of the final destination.

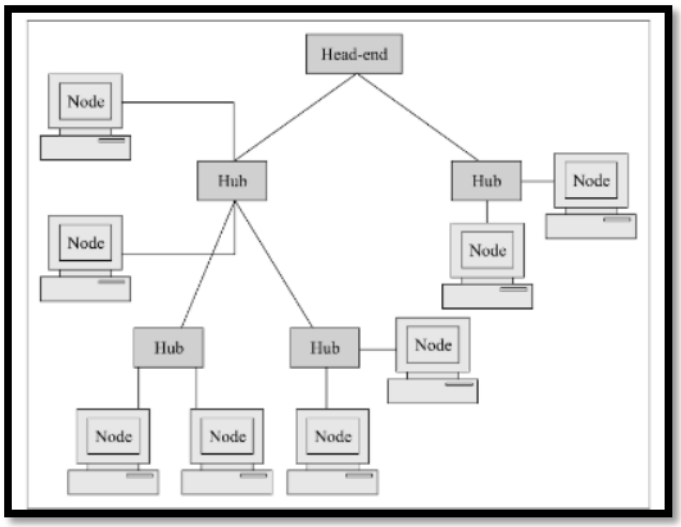
OR

IPv6 header:

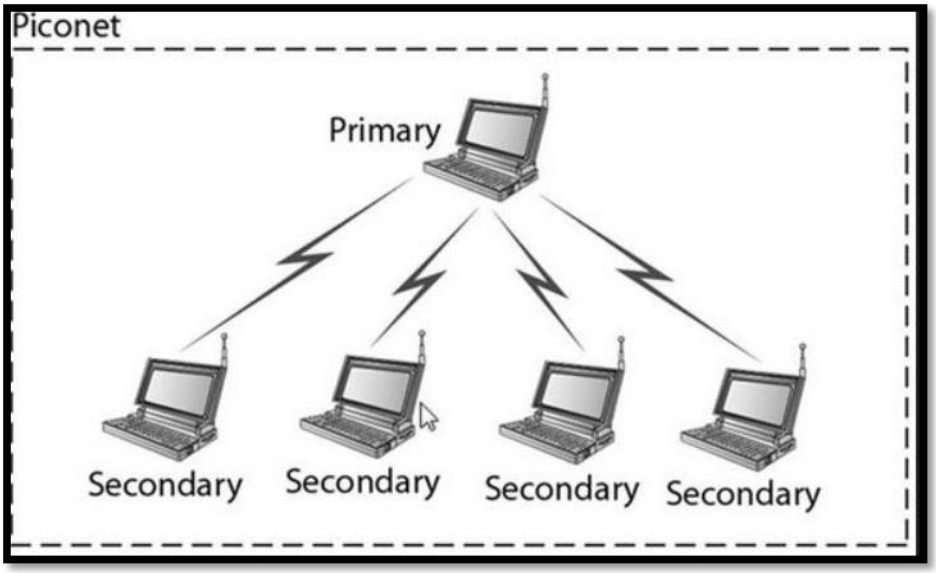


IPv6 fixed header is 40 bytes long and contains the following information.
Version (4 bit): It represents the version of Internet Protocol, i.e. 0110
Traffic Class (8-bits): These 8 bit are divided into two parts. The most significant 6 bits are used for Type of Service to let the Router Known what services should be provided to this packet. The least significant 2 bits are used for Explicit Congestion Notification (ECN).
Flow label (20-bits): This label is used to maintain the sequential flow of the packets belonging to a communication. The source labels the sequence to help the router identify that a particular packet belongs to a specific flow of information. This field helps avoid re-ordering of data packets. It is designed for streaming/real –time media.
Payload Length (16-bits): This field is used to tell the routers how much information a particular packet contains in its payload. Payload is composed of Extension Headers and Upper Layer data. With 16 bits, up to 65535 bytes can be indicated, but if the Extension Headers contain Hop-by-Hop Extension Header, then the payload may exceed 65535 bytes and this field is set to 0.
Next Header (8-bits): This field is used to indicate either the type of Extension Header, or if the Extension Header is not present then it indicates the Upper Layer PDU. The values for the type of Upper Layer.
Hop Limit (8-bits): This field is used to stop packet to loop in the network infinitely. This is same as TTL in IPV4. The value of Hop Limit field is decremented by 1 as it passes a link (router/hop). When the field reaches 0 the packets is discarded.
Source Address (128-bits): This field indicates the address of originator of the packet.
Destination Address (128–bits): This field provides the address of intended recipient of the packet.

5		**Solve any FOUR :**	**16 M**
	a	**Explain tree topology with neat diagram.**	4 M
	Ans	**Tree Topology:** 1. A tree topology is cascading of star.	2 Marks:- Explanation;

		2. As in a star, nodes in a tree are linked to a central hub head end that controls the traffic to a network. However, not every computer plugs into the central hub, majority of them are connected to a secondary hub which in turn is connected to the central hub as shown in fig. **3.** The central hub head is either a switch or a router.  4. The central hub contains a repeater, which looks at the incoming bits and 99 regenerates them afresh as full blown signals for 0 or 1 as per case. 5. This allows the digital signals to traverse over longer distances. 6. Therefore, the central hub is also called active hub. **7.** The tree topology also contains many secondary hubs, which may be active hubs or passive hubs.	2 Marks:- Diagram **Note: Any other diagram showing central hub and other connection may also be considered**
	b	**Explain Bluetooth protocol architecture.**	4 M
	Ans	• Bluetooth is short range wireless technology. • Range of Bluetooth is 10 meters. • Bluetooth Architecture defines 2 types of networks. 1)Piconet 2)Scatternet **Piconet** 1. It consists of 1 master node and 7 slave nodes. 2. Piconet have 8 active nodes (7+1) in the range of 10 meters. 3. There can be only 1 master station in each piconet.	2 Marks:- Piconet Diagram & Explanation; 2 Marks:- Scatternet Diagram & Explanation)

4. Communication is between master and slave
5. Slave-slave communication is not possible.
6. Piconet can have 255 parked nodes, that cannot take part in communication
7. There will be 7 slaves in active state and 255 nodes in parked state.



Scatternet

1. It is formed by combining various piconets.
2. Slave in one piconet can act as master in other piconet.
3. Such a node can receive message from the master in the first piconet and deliver the message in second piconet.
4. Station can be member of two piconets.
5. Station cannot be master of two piconet.

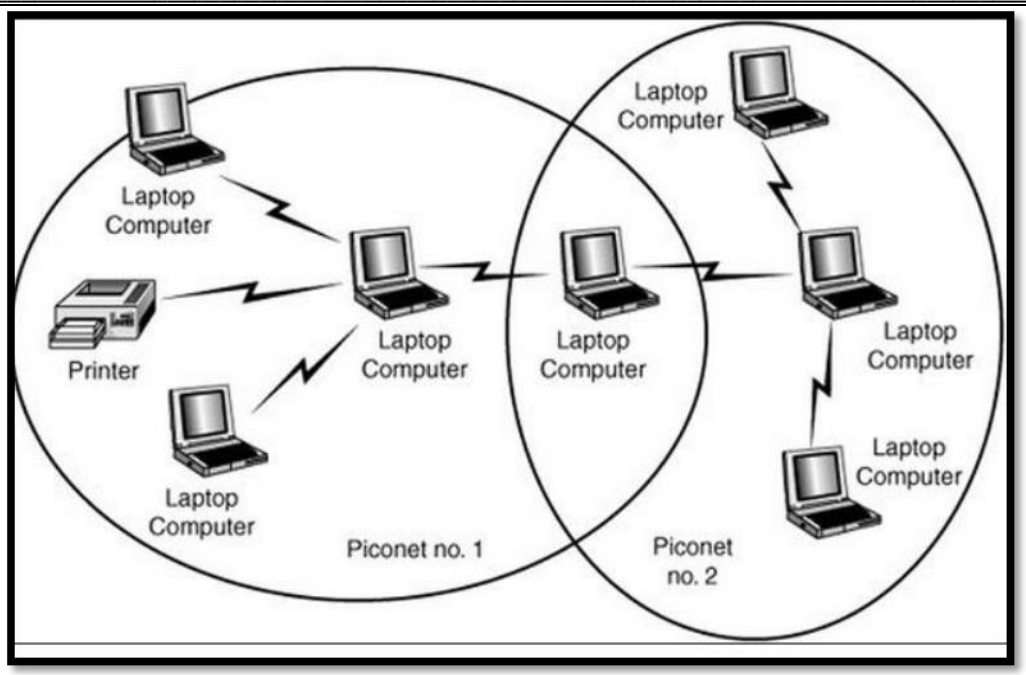
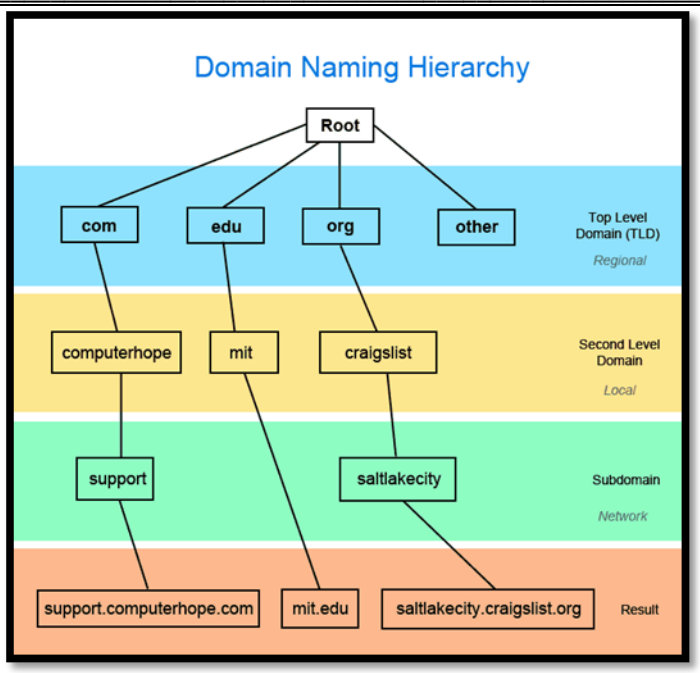


Fig: Scatternet

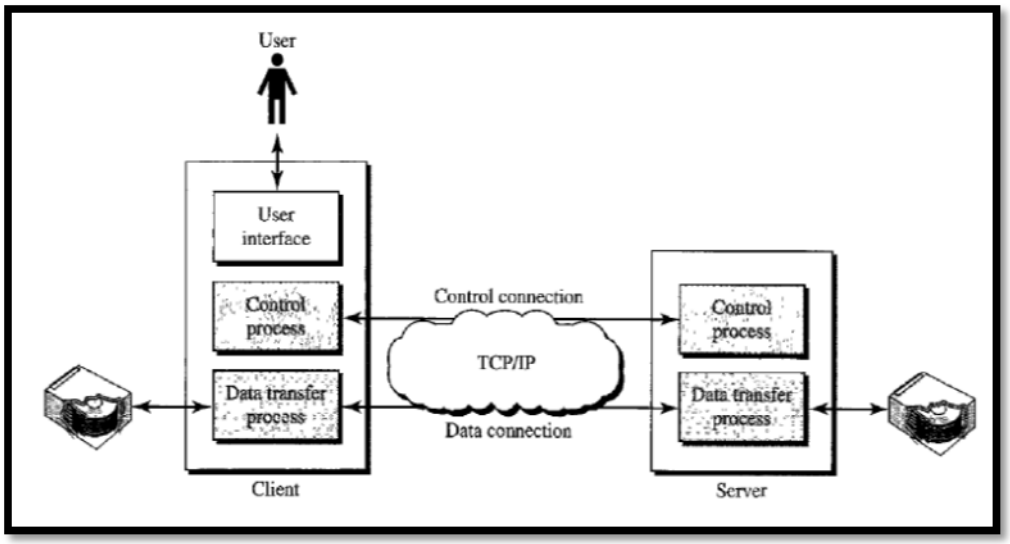
	c	**Write a short note on SLIP and PPP.**	4 M
	Ans	**SLIP** 1. Serial Line Protocol is an encapsulation of the Internet Protocol designed to work over serial ports and modem connections. 2. This packet-framing protocol and defines a sequence of bytes that frame IP packets on a serial line. 3. SLIP is commonly used for point-to-point serial connections running TCP/IP 4. It is designed to transmit signals over a serial connection and has very low overhead. 5. SLIP is serial line internet protocol 6. SLIP does not perform error detection and correction. 7. SLIP does not provide any authentication. 8. SLIP is not approved internet standard. 9. SLIP supports static IP address assignment **PPP** 1. PPP is point to point protocol. 2. It is a much more developed protocol than SLIP(which is why it is replacing it).	2 Marks:- SLIP Explanation; 2 Marks:- PPP Explanation

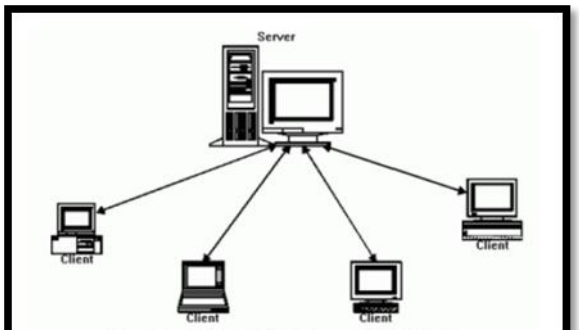
		3. It transfers additional data, better suited to data transmission over the Internet (the addition of data in a frame is mainly due to the increase in bandwidth). 4. PPP perform error detection 5. PPP provides authentication and security. 6. PPP is approved internet standard. 7. PPP supports IP and other protocols. 8. PPP supports Dynamic IP address assignment 9. PPP is a collection of three protocols: ❖ A datagram encapsulation protocol ❖ LCP i.e. Link Control Protocol, enabling testing and communication configuration. ❖ A collection of NCPs i.e. Network Control Protocols allowing integration control of PPP within the protocols of the upper layers.	
	d	**What is segmentation and reassembly?**	4 M
	Ans	**Segmentation** 1. Segmentation is the term used to describe the process of dividing streams of data into smaller chunks. 2. Segmentation usually occurs fairly early in the communication process and it is almost always software that performs the segmentation process. 3. The segmentation process is performed prior to transfer of data across a network or before storage on a peripheral device. 4. Segmentation is necessary because today's communication systems use what is called *packetized* communication. 5. A message is divided into segments; each segment contains sequence number, which enables this layer in reassembling the message. **Reassembly:** 1. Reassembly is the reverse of segmentation. Protocol Data Units are put back together in the correct order to reassemble a stream of data in its original form.	2 Marks- segmentation explanation; 2 Marks- Reassembly Explanation

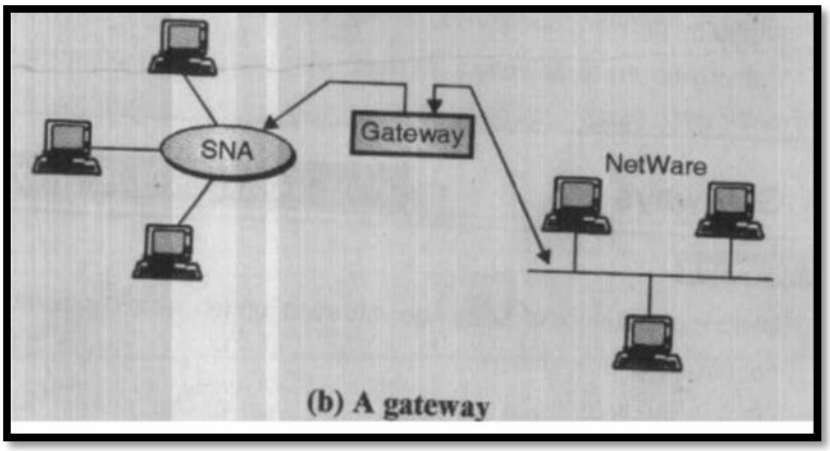
		2. Message is reassembled correctly by arranging them sequence number wise; upon arrival at the destination and replaces packets which were lost in transmission.	
	e	**Explain the term Domain Name Space.**	4 M
	Ans	1. A domain namespace is a name service provided by the Internet for Transmission Control Protocol networks/Internet Protocol (TCP/IP). 2. DNS is broken up into domains, a logical organization of computers that exist in a larger network. 3. The DNS database hierarchical naming scheme is called a **domain name space**. 4. Each node in the hierarchy represents a partition of the DNS database. 5. The nodes are known as **domains**, and each of them must have a name as the DNS database is indexed by name. When you add domains to the hierarchy, the name of **the parent domain** is appended to the domain, which becomes a **child domain** or **subdomain**. 6. The hierarchical structure of the domain name space consists of a root domain, top-level domains, second level domains, subdomains, and host names. • The **Root Domain** is at the top of the hierarchy and is represented by a period (.). • **Top-Level Domains** are two or three-character name codes, representing organisation type or geographic location, eg: .com, .gov, .edu, .uk, .es etc. Top-level domains can contain second-level domains and host names. • **Second-Level Domains** are registered to individuals and organisations for use on the Internet. A second-level name has two name components: a top-level name and a unique second-level name, eg: *coatbank.com.* • **Subdomains** are created when organisations extend their DNS tree to represent departments, divisions, or other geographic locations. Subdomains have three name components: a top-level name, a unique second-level name, and a unique name representing the department or location, eg: admin.coatbank.com. 7. Below is an example of the hierarchy of domain naming on the Internet.	any relevant explanation 4 marks with example



8. In the above example, all websites are broken into regional sections based on the TLD (top-level domain). In the example of http://support.computerhope.com it has a ".com" TLD, with "computerhope" as its second level domain that is local to the .com TLD, and "support" as its subdomain, which is determined by its server.

	f	**Explain the principle of FTP**	4 M
	Ans	 **Explanation:** 1. File Transfer Protocol (FTP) is the standard mechanism provided by *TCP/IP* for copying a file from one host to another. Figure shows the basic model of FTP.	2 Marks:- Diagram; 2 Marks:- Explanation

		2. The client has three components: user interface, client control process, and the client data transfer process. The server has two components: the server control process and the server data transfer process. 3. The control connection is made between the control processes. The data connection is made between the data transfer processes. 4. The control connection remains connected during the entire interactive FTP session. 5. The data connection is opened and then closed for each file transferred. It opens each time commands that involve transferring files are used, and it closes when the file is transferred. In other words, when a user starts an FTP session, the control connection opens. While the control connection is open, the data connection can be opened and closed multiple times if several files are transferred. 6. Separation of commands and data transfer makes FTP more efficient. FTP uses the services of TCP. It needs two TCP connections. 7. FTP uses two well-known TCP ports: Port 21 and Port 20.	
6		**Solve any TWO :**	**16 M**
	a	**With neat diagram explain client server network along with its advantages and disadvantages.**	8 M
	Ans	**Diagram:-**  Figure: Client Server Architecture **Explanation:-** 1. Client server Architecture consists of Client computers or nodes, which are connected to centralized server. 2. The servers stores all the network's shared files and applications programs, such as word processor documents, compilers, database applications, spreadsheets, and the network operating system. 3. Client will send request to access information from the server based on the request server will send the required information to the client. **Advantages of Client Server Network:**	2 Marks-Diagram; 2 Mark-Explanation; 2 Marks-Advantages; 2 Marks-disadvantages

		1. It has the centralized control. i.e. centralized user accounts, security, and access to simplify network administration. 2. It does not slow down with heavy use. 3. The size of the network can be expanded to any size. 4. Proper Management in which all files are stored at the same place. In this way, management of files becomes easy. Also it becomes easier to find files. 5. As all the data is stored on server it's easy to make a back-up of it. 6. Reduces Data duplication by storing data stored on the servers instead of each client, so it reduces the amount of data duplication for the application. **Disadvantages of Client Server Network:-** 1. Server failure leads to whole network failure. 2. It is very expensive to install and manage as dedicated hardware (server) and special software is required. 3. A Professional IT person is required to maintain the servers and other technical details of network.	
	b	**What is Gateway? Explain and state its operation.**	8 M
	Ans	 (b) A gateway 1. A gateway is a node (router) in a computer network, a key stopping point for data on its way to or from other networks. 2. Gateway is protocol converter. 3. Gateway enables communication between different network architecture and environments. 4. It works at all layers of OSI model. **Operations of Gateway:** 1. Gateway connects two systems that do not use the same protocol, data format, language and architecture. 2. Convert commonly used protocols (e.g. TCP/IP) to a specialized protocol (for example, an SNA: System Network Architecture). 3. Convert message formats from one format to another. It translates different addressing schemes 4. Using gateways, we are able to communicate and send data back and forth. The Internet wouldn't be any use to us without gateways (as well as a lot of other	2 Marks:- Diagram; 2 Marks:- What is Gateway; 4 marks:- operation

hardware and software).

5. A gateway is a node (router) in a computer network, a key stopping point for data on its way to or from other networks. The Internet wouldn't be any use to us without gateways (as well as a lot of other hardware and software).
6. In a workplace, the gateway is the computer that routes traffic from a workstation to the outside network that is serving up the Web pages. For basic Internet connections at home, the gateway is the Internet Service Provider that gives you access to the entire Internet.
7. On the Internet, the node that's a stopping point can be a gateway or a host node.
8. A computer that controls the traffic your Internet Service Provider (ISP) receives is a node.
9. If you have a wireless network at home that gives your entire family access to the Internet, your gateway is the modem (or modem-router combo) your ISP provides so you can connect to their network. On the other end, the computer that controls all of the data traffic your Internet Service Provider (ISP) takes and sends out is itself a node.
10. When a computer-server acts as a gateway, it also operates as a firewall and a proxy server. A firewall keeps out unwanted traffic and outsiders off a private network. A proxy server is software that "sits" between programs on your computer that you use (such as a Web browser) and a computer server—the computer that serves your network. The proxy server's task is to make sure the real server can handle your online data requests

c **Compare OSI and TCP/IP.** 8 M

Ans any 8 correct 1 Mark each

OSI	TCP/IP
1. OSI is a generic, protocol independent standard, acting as a communication gateway between the network and end user.	1. TCP/IP model is based on standard protocols around which the Internet has developed. It is a communication protocol, which allows connection of hosts over a network.
2. In OSI model the transport layer guarantees the delivery of packets.	2. In TCP/IP model the transport layer does not guarantees delivery of packets. Still the TCP/IP model is more reliable.
3. Follows vertical approach.	3. Follows horizontal approach.
4. OSI model has a separate Presentation layer and Session layer.	4. TCP/IP does not have a separate Presentation layer or Session layer.
5. OSI is a reference model around which the networks are built. Generally it is used as a guidance tool.	5. TCP/IP model is, in a way implementation of the OSI model.

			6. Network layer of OSI model provides both connection oriented and connectionless service.	6. The Network layer in TCP/IP model provides connectionless service.	
			7. OSI model has a problem of fitting the protocols into the model.	7. TCP/IP model does not fit any protocol	
			8. Protocols are hidden in OSI model and are easily replaced as the technology changes.	8. In TCP/IP replacing protocol is not easy.	