



Subject Name: Computer Network
WINTER- 17 EXAMINATION
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.	A)	Attempt any six :	Marks 12
	a)	Define computer network.	2M
	Ans:	A network consists of two or more computers that are linked in order to share resources (such as printers and CDs), exchange files, or allow electronic communications. The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.	(Definition : 2marks)
	b)	Give advantages of computer network.	2M
	Ans:	Advantages of Computer Network 1. File sharing: The major advantage of computer network is that it allows file sharing and remote file access. A person sitting at one workstation that is connected to a network can easily see files present on another workstation, provided he/she is authorized to do so. 2. 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. 3. Inexpensive set-up: Shared resources means reduction in hardware costs. Shared files means reduction in memory requirement, which indirectly means reduction in file storage expenses.	(Any 2 advantages :2marks)



	4. 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.	
	c) What is hub? Give types of hub.	2M
Ans:	HUB: Hub is a connecting device; it is also known as multiport repeater. It is normally used for connecting stations in a physical star topology All networks require a central location to bring media segments together. These central locations are called hubs. A hub organizes the cables and relays signals to the other media segments. There are three main types of hubs: 1. Passive Hub 2. Active Hub 3. Intelligent Hub	(Hub:1 mark, Types: 1mark)
	d) What are the various network control devices?	2M
Ans:	Network Control device: 1. Repeater 2. Hub 3. Switch 4. Bridge 5. Router 6. Gateway 7. Modem	(Listing of any 4 control devices: 1/2 mark each)
	e) Why the network cable is twisted?	2M
Ans:	Twisted pair cabling is a type of wiring in which two conductors of a single circuit are twisted together for the purposes of canceling out electromagnetic interference (EMI) from external sources; for instance, electromagnetic radiation from unshielded twisted pair (UTP) cables, and crosstalk between neighboring pairs.	(Relevant explanation : 2 marks)
	f) State any two advantages of coaxial cable.	2M
Ans:	1. Transmits digital signals at a very high speed of 10 Mbps 2. Greater channel capacity. 3. Greater bandwidth 4. Lower error rates. 5. Data Transmission without distortion. 6. Greater spacing between amplifier	(Any 2 advantages :1 mark each)
	g) What is Layered Architecture?	2M
Ans:	To reduce the design complexity, most of the networks are organized as a series of layers or levels, each one build upon one below it. Layered architecture is to divide the design 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. The benefits of the layered architecture is modularity and clear interfaces, i.e. open architecture and comparability between the different provider's components.	(Relevant explanation : 2 marks)



	h)	What is IP address? State IP address classes.	2M
		<p>Internet Protocol address (IP address) is a numerical label assigned to each device (e.g., computer, printer) participating in a computer network that uses the Internet Protocol for communication. An IP address serves two principal functions: host or network interface identification and location addressing. IPv4 address is of 32 bit.</p> <p>The IPv4 addresses are classified into 5 types as follows:</p> <ol style="list-style-type: none">1. Class A2. Class B3. Class C4. Class D5. Class E	(IP address: 1 mark, Classes Listing: 1 mark)
	B)	Attempt any two :	Marks 8
	a)	Explain computer network facilities in terms of centralized network management.	4M
	Ans:	<p>The Computer network facilitates centralized network management in following aspects</p> <ol style="list-style-type: none">1. Management of Software: Expensive software can be installed on one centralized computer and they can be accessed by other computers in a network.2. Maintenance of network: Because of centralized management, maintenance of network becomes easy an administrator can keep track of network performance, speed and security from centralized computer3. Keeping data Backup: It may happen that the data on any one computer system is accidentally lost due to system failure, computer viruses or human error. To avoid this, data from computer system's disk is copied to some other medium for keeping it safe. Such backups are important to retrieve the lost data.4. Network security: It becomes easy to maintain network with respect to virus and malware attacks using centralized management	(Each facility: 1 mark)
	b)	Describe router with neat and labeled diagram. State the situation under which router are necessary in network.	4M
	Ans:	<p>Router:</p> <ul style="list-style-type: none">• It operates at the network layer.• A router normally connects LANs and WANs in the Internet and has a routing table that is used for making decisions about the route. The routing tables are normally dynamic and are updated using routing protocols.• Routers are devices that help in determining the best path out of the available paths, for a particular transmission. They consist of a combination of hardware and software.	(Diagram: 1 mark, Description :2 marks, Situation: 1 mark)

- The two main kinds of software in a router are the operating system and the routing protocol.
- Routers use logical and physical addressing to connect two or more logically separate networks.
- Messages are stored in the routers before re-transmission, routers are said to implement a store-and-forward technique.

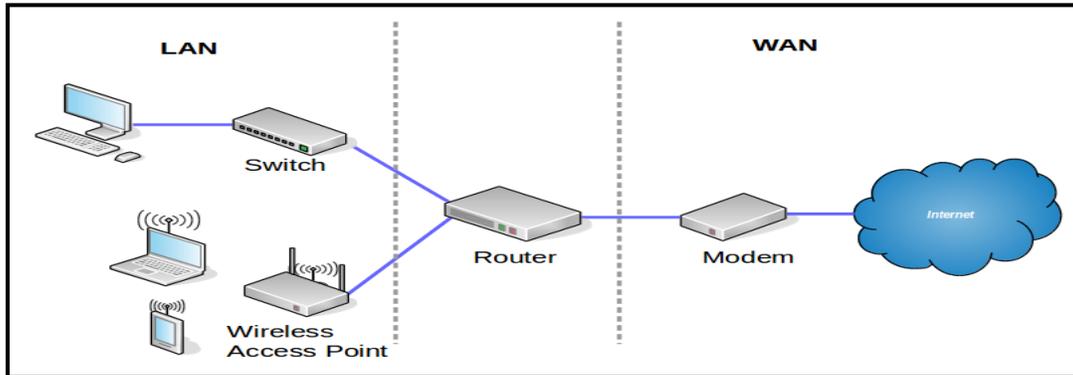


Fig: Router

Situation under which router can be used:

The router is a fundamental building block of modern business networks, providing traffic with a gateway to both the Internet and other networks. Routers play important roles on a network, with many combined with other devices such as firewalls, modems and switches to provide networking solutions.

c) Explain the operation of modem.

4M

Ans:

MODEM: Modem works as modulator as well as demodulator. Modem converts analog signal to digital signal and vice versa. In case of networking data has to be transferred from one location to another location. At present to transfer such data whatever the infrastructure (PSTN) is available is of analog technology but computer sends digital data to transfer this data to another location. Thus it is needed to convert into analog format so that it can be transferred by using currently available infrastructure

(Diagram: 2 marks, Explanation :2 marks)

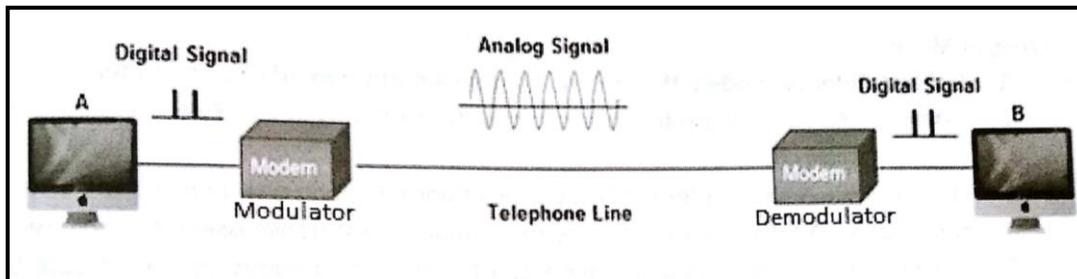


Fig: Modem



2.		Attempt any four :	Marks 16
	a)	What is meant by file sharing and printer sharing? How this can be achieved?	4M
	Ans:	<p>1. File sharing: It is the practice of distributing or providing access to digital media, such as computer programs, multimedia (audio, images and video), documents or electronic books.</p> <p>File sharing typically involves word-processing files, spreadsheets, and other files to which many people need regular access. It requires a shared directory or disk drive that many users can access over the network, along with the underlying programming logic needed to make sure that more than one person doesn't make changes to a file at the same time (called file locking). The reason you don't want multiple people making changes to a file at the same time is that they might both be making conflicting changes simultaneously without realizing it.</p> <p>2. Printer sharing: Printer sharing is beneficial to many users as they can share costly & higher quality printers. Printer sharing can be done in several different ways on network.</p> <p>The most common way is to use printer queues on server. The printer queue holds print job until any currently running print jobs are finished & then automatically send the waiting jobs to the printer i.e. printer connected to server. Another way to share printer on a network is that each workstations accesses the printer directly.</p>	(Explanation: 1mark Each, How it can be achieved(A ny Relevant answer): 1mark each)
	b)	State various network features. Explain any one in detail.	4M
	Ans:	<p>Network features:</p> <ol style="list-style-type: none">1. File Sharing2. Printer Sharing3. Application Services4. E-mail Services5. Remote access6. Internet & Intranet <p>1) File sharing: File sharing is the primary feature of network. Due to use of networks, the sharing of files becomes easier. File sharing requires a shared directory or disk drive to which many users can access over the network. When many users are accessing the same file on the network, more than one person can make changes to a file at the same time. They might both making conflicting changes simultaneously.</p> <p>2) Printer sharing: Printer sharing is beneficial to many users as they can share costly & higher quality printers. Printer sharing can be done in several different ways on network. The most common way is to use printer queues on server. The printer queue holds print job until any currently running print jobs are finished & then automatically send the waiting jobs to the printer i.e. printer connected to server. Another way to share printer on a network is that each workstations accesses the printer directly.</p>	(State: 2 marks, Explanation of any one: 2marks)



	<p>3) Application services: You can also share application on a network. For example you can have a shared copy of Microsoft office or some other application & keep it on the network server. Another application services you can have on the network is shared installation i.e. contents of CD-ROM copy to the server, then run the installation the installing application much faster & more convenient.</p> <p>4) E- mail services: E-mail is extremely valuable & important feature for communication within organization or outside the people in world. E-mail service can be used by user in two different ways: 1. File based 2.Client File based e-mail system requires gateway server for connecting or handling the e-mail interface between the two systems using gateway software that is part of the file-based e-mail system. A client-server e-mail system is one where an e-mail server containing the messages & handles all incoming & outgoing mail. It is more secure & powerful than file based e-mail system.</p> <p>5) Remote access: Using this feature user can access their file & e-mail, when they are travelling or working on remote location. It enables users to access to centralized application, stored private or shared files on LAN.</p> <p>6) Internet & Intranet: Internet: It is public network. This consists of thousands of individual networks & millions of computers located around the world. Internets have many different types of services available such as e-mail, the web & Usenet newsgroups. Intranet: It is private network or it is company's own network. Company use this feature for internal use. For example: company establish its own web server, for placing documents such as employee handbooks, purchases form or other information that company publishes for internal use. It also has internet services such as FTP servers or Usenet servers.</p>	
	<p>c) Define the following term : 1) Roaming 2) Soft hand off 3) GSM 4) AMPS</p>	
<p>Ans:</p>	<p>1) Roaming: It is the ability for a cellular customer to automatically make and receive voice calls, send and receive data, or access other services, including home data services, when travelling outside the geographical coverage area of the home network, by means of using a visited network.</p> <p>2) Soft hand off: The hand off is known as soft handoff if the MS starts communication with a new base station without stopping the communication with the older base station.</p> <p>3) GSM: (Global System for Mobile communication) is a digital mobile telephony system which uses a variation of time division multiple access (TDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot.</p> <p>4) AMPS: Advanced Mobile Phone Service (AMPS) is a standard system for analog signal cellular telephone service. It uses FDMA to separate channels in a link.</p>	<p>(Each definition: 1 mark)</p>

d) With neat diagram, explain satellite communication system. 4M

Ans: **Satellite Communication:** In satellite communication, signal transferring between the sender and receiver is done with the help of satellite. In this process, the signal which is basically a beam of modulated microwaves is sent towards the satellite called UPLINK (6Ghz). 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

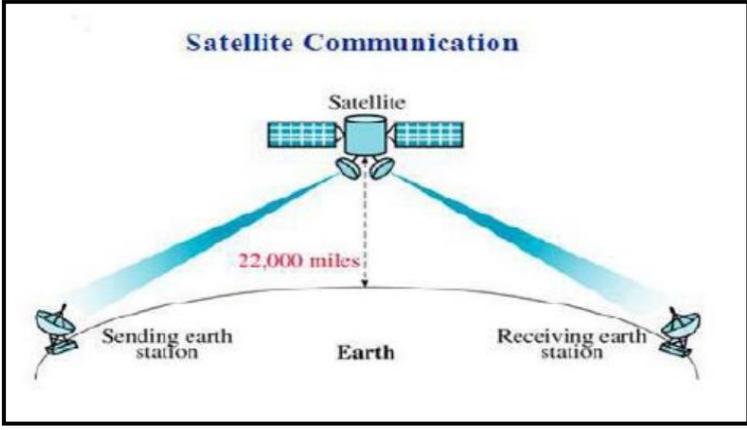


Fig: Satellite Communication

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 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. Therefore Geosynchronous satellites are used which move at same RPM as that of the earth in the same direction. So the relative position of the ground station with respect to the satellite never changes

(Diagram: 2 marks, Explanation: 2 marks)

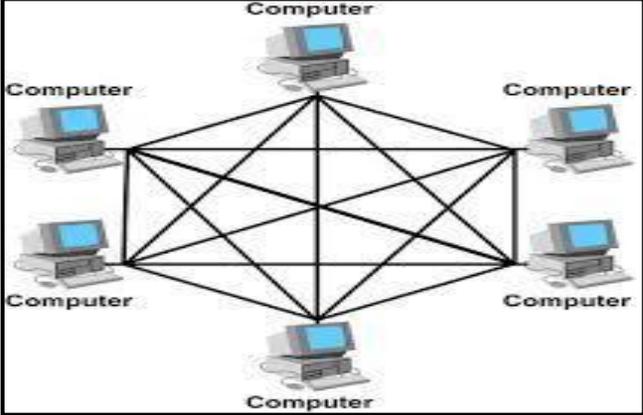
e) Compare client server and peer to peer network. 4M

Ans:

Client server Network	Peer to peer network
Centralized management.	Decentralized management.
In this server has more power & client has less power.	In this each machine has same power
It is hardware intensive.	Uses less expensive computer hardware.
Complex to setup & require professional administrator.	Easy to setup & administrator.
Very secure	Less secure
Network O.S required	Network O.S not required
It support large Network	It support small Network

(Any 4 difference :1mark each)

	f)	Explain basic principles of mobile communication.	4M
	Ans:	<ol style="list-style-type: none"> 1. The first mobile telephone system had a single channel for both sending and receiving in as early as 1946. 2. Second development took place in 1960s. This was called Improved Mobile Telephone System (IMTS) 3. It had a strong transmitter and used for two frequencies – one for sending and other for receiving. 4. The third step was the development of Advanced Mobile Phone system (AMPS), the area covered is conceptually divided in small regions known as cells, thus the name cellular phones. Each cell has an antenna and a cell office to control that cell. 5. MTSO controls various such cell offices and coordinates the communication between them and the Telephone central office 6. Telephone central office is a part of the wired land telephone system. 7. The computer at MTSO is responsible for not only the connections but also for the information and billing of cells 8. The typical cell radius size is 0 to 12 miles. 	(Any relevant answer: 4 marks)
3.		Attempt any four :	Marks 16
	a)	With neat diagram explain client server network along with its advantages and disadvantages.	4M
	Ans:	<ul style="list-style-type: none"> • 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. <div style="text-align: center; margin: 10px 0;"> </div> <ul style="list-style-type: none"> • Advantages of Client Server Network: <ol style="list-style-type: none"> 2) It has the centralized control i.e. centralized user accounts, security, and access to simplify network administration. 3) It does not slow down with heavy use. 4) The size of the network can be expanded to any size. 5) 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. 6) As all the data is stored on server it's easy to make a back-up of it. 	(Diagram: 1 mark , Explanation:1 mark, Any 2 Advantages :1 mark, Any 2 Disadvantages:1 mark)

	<p>7) 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.</p> <ul style="list-style-type: none"> • Disadvantages of Client Server Network: <ol style="list-style-type: none"> 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. 	
	<p>b) Explain mesh topology with suitable diagram.</p>	<p>4M</p>
<p>Ans:</p>	<div style="text-align: center;">  </div> <ul style="list-style-type: none"> • In a mesh network topology, each of the network node, computer and other devices, are interconnected with one another. • Every node not only sends its own signals but also relays data from other nodes. • In fact a true mesh topology is the one where every node is connected to every other node in the network. • This type of topology is very expensive as there are many redundant connections, thus it is not mostly used in computer networks. • It is commonly used in wireless networks. • Flooding or routing technique is used in mesh topology. 	<p>(Diagram: 2 marks, Explanation: 2 marks)</p>
	<p>c) Describe the OSI model with neat diagram.</p>	<p>4M</p>
<p>Ans:</p>	<p>OSI model (open system interconnection) model was developed by ISO (international standard organization)</p> <p>Function of OSI model:</p> <ol style="list-style-type: none"> i. It provides way to understand how internetwork operates. ii. It gives guideline for creating network standard. 	<p>(Diagram: 1 mark, Explanation: 3 marks)</p>



OSI model has 7 layers as shown in the figure.

Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data link Layer
Physical Layer

OSI model has following 7 layers as Physical layer, data link layer, Network layer, Transport layer, session layer, presentation layer, application layer.

1. Physical layer:

- It co-ordinates the functions required to transmit bit stream over physical medium.
- It deals with mechanical and electrical specifications of interface and transmission medium.
- For transmission it defines procedures and functions that devices and transmission medium has to perform
 - ❖ Physical characteristics of interfaces and media.
 - ❖ Representation of bits: Data rate (transmission rate).
 - ❖ Synchronization of bits.
 - ❖ Line configuration: Point to point or multipoint configuration should be used.

2. Data link layer:

- It is responsible for transmitting group of bits between the adjacent nodes. The group of bits is called as frame.
- The network layer passes a data unit to the data link layer.
- Header and trailer is added to the data unit by data link layer.
- This data unit is passed to the physical layer.
- Data link layer is responsible for moving frames from one node to the next.
- Functions of data link layer are:
 - ❖ Framing
 - ❖ Physical addressing
 - ❖ Flow control
 - ❖ Error control
 - ❖ Media access control
 - ❖ Node to node delivery

3. Network layer:

- It is responsible for routing the packets within the subnet i.e. from source to destination.
- It is responsible for source to destination delivery of individual packets across multiple networks.
- It ensures that packet is delivered from point of origin to destination.
- Functions of network layer:
 - ❖ logical addressing



- ❖ Routing.
- ❖ Congestion control
- ❖ Accounting and billing
- ❖ Address transformation
- ❖ Source host to destination host error free delivery of packet.

4. Transport layer:

- Responsibility of process to process delivery of message Ensure that whole message arrives in order.
- Functions of Transport layer:
 - ❖ Service point addressing
 - ❖ Segmentation and reassembly
 - ❖ Connection control
 - ❖ Flow control: Flow control is performed end to end.
 - ❖ Error Control

5. Session layer:

- Establishes, maintains, and synchronizes the interaction among communication systems
- It is responsible for dialog control and synchronization.
- Functions of Session layer:
 - ❖ Dialog control
 - ❖ Synchronization, session and sub session
 - ❖ Session closure

6. Presentation layer:

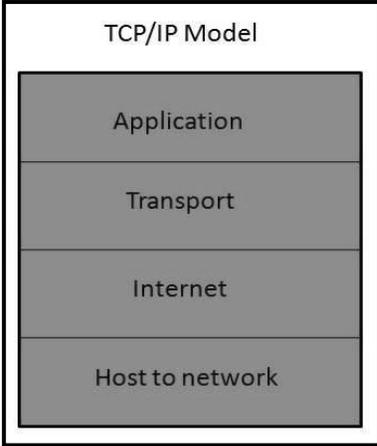
- It is concerned with syntax, semantics of information exchanged between the two systems.
- Functions of Presentation layer:
 - ❖ **Translation:** presentation layer is responsible for converting various formats into required format of the recipient
 - ❖ **Encryption:** Data encryption and decryption is done by presentation layer for security.
 - ❖ **Compression and Decompression:** data to be transform compressed while sending and decompress while receiving for reducing time of transmission.

7. Application layer:

- It enables user to access the network.
- It provides user interfaces and support for services like email, remote file access.
- Functions of Application layer:
 - ❖ Network virtual terminal
 - ❖ file transfer access and management
 - ❖ mail services and directory services

	d)	Describe data encapsulation.	4M
Ans:			<p>(Diagram: 2 marks, Explanation: 2 marks)</p>
		<p>Explanation:</p> <ul style="list-style-type: none"> • The protocols operating at the various layers work together to supply a unified quality of service. • Each protocol layer provides a service to the layers directly above and below it. • The process of adding the headers and trailers to the data is called as data encapsulation. • A packet(header and data) at level 7 is encapsulated in a packet at level 6.The whole packet at level 6 is encapsulated in a packet at level 5, and so on. In other words, the data portion of a packet at level N-1 carries the whole packet (data and header and maybe trailer) from level N. 	
	e)	State any four protocol associated with application layer of OSI model.	4M
Ans:	<p>Protocol associated with Application layer of OSI Reference model are</p> <ol style="list-style-type: none"> 1. Virtual Terminal (TELNET) 2. File transfer Protocol (FTP) 3. Simple Mail Transfer Protocol (SMTP) 4. Hypertext Transport Protocol (HTTP) 5. Domain Name System (DNS) 		<p>(Any 4 correct protocols: 1 mark each)</p>



	f)	Differentiate between SLIP and PPP.	4M																
	Ans:	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 50%;">SLIP</th> <th style="width: 50%;">PPP</th> </tr> </thead> <tbody> <tr> <td>Serial Line Internet Protocol does not establish or maintain connection between the client and ISP server.</td> <td>In PPP, LCP (Line Control Protocol) is responsible for establishing, maintaining and termination connection between two end points.</td> </tr> <tr> <td>Communication starts once the connection between two modems are established.</td> <td>Communication begins only after authentication and the types of traffic is sent by the client.</td> </tr> <tr> <td>Type of traffic cannot be selected in SLIP.</td> <td>Type of traffic can be selected by NCP (Network Control Protocol)</td> </tr> <tr> <td>No protocol for termination.</td> <td>IPCP/IP (Control Protocol) terminates a network layer connection between the user and ISP.</td> </tr> <tr> <td>No addressing mechanism provided.</td> <td>Additional services for addressing mechanism is provided</td> </tr> <tr> <td>Doesn't allow error control</td> <td>Allows error control</td> </tr> <tr> <td>No provision for data compression</td> <td>Provides Data compression.</td> </tr> </tbody> </table>	SLIP	PPP	Serial Line Internet Protocol does not establish or maintain connection between the client and ISP server.	In PPP, LCP (Line Control Protocol) is responsible for establishing, maintaining and termination connection between two end points.	Communication starts once the connection between two modems are established.	Communication begins only after authentication and the types of traffic is sent by the client.	Type of traffic cannot be selected in SLIP.	Type of traffic can be selected by NCP (Network Control Protocol)	No protocol for termination.	IPCP/IP (Control Protocol) terminates a network layer connection between the user and ISP.	No addressing mechanism provided.	Additional services for addressing mechanism is provided	Doesn't allow error control	Allows error control	No provision for data compression	Provides Data compression.	(Any 4 correct points: 1 mark each)
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	a)	Explain TCP/IP reference model with diagram.	4M																
	Ans:	<div style="text-align: center;">  <p>The diagram shows a vertical stack of four rectangular boxes representing the layers of the TCP/IP model. From top to bottom, they are labeled: Application, Transport, Internet, and Host to network. The entire stack is enclosed in a larger rectangular frame with the title 'TCP/IP Model' centered above it.</p> </div> <p>TCP/IP Reference Model:</p> <ul style="list-style-type: none"> • TCP/IP means transmission control protocol and internet protocol. • Protocols are set of rules which govern every possible communication over the internet. • These protocols describe the movement of data between the host computers or internet. These offer simple naming and addressing schemes. • It is robust to failures and flexible to diverse networks. 	(Diagram: 1mark, Explanation: 3marks)																



	<ul style="list-style-type: none">• Most widely used protocol for interconnecting computers and it is the protocol of the internet. <p>Description of different TCP/IP layers</p> <p>❖ Layer 1: Host-to-network Layer</p> <ol style="list-style-type: none">1. Protocol is used to connect the host, so that the packets can be sent over it.2. Varies host to host and network to network. <p>❖ Layer 2: Internet layer</p> <ol style="list-style-type: none">1. Selection of a packet switching network which is based on a connectionless internetwork layer is called internet layer.2. It the layer which holds the whole architecture together.3. It allows the host to insert the packets.4. It helps the packet to travel independently to the destination.5. Order in which packets are received is different from the way they are sent.6. IP (internet protocol) is used in this layer. <p>❖ Layer 3: Transport Layer</p> <ol style="list-style-type: none">1. It decides if data transmission should be on parallel path or single path.2. Functions such as multiplexing, segmenting or splitting on the data done by layer four that is transport layer.3. Transport layer breaks the message (data) into small units so that they are handled more efficiently by the network layer.4. Functions of the transport layer are same as the OSI model.5. Transport layer also arrange the packets sent in sequence. <p>❖ Layer 4: Application Layer</p> <ol style="list-style-type: none">1. Protocols used in this layer are high level protocols such as TELNET, FTP (file transfer protocol etc.	
	<p>b) Explain subnet masking.</p>	<p>4M</p>
<p>Ans:</p>	<ul style="list-style-type: none">• An IP address has two components, the network address and the host address.• A subnet mask separates the IP address into the network and host addresses.• In Internet Protocol (IP) networking, devices on a subnet share contiguous ranges of IP address numbers.• A mask (known as the subnet mask or network mask) defines the boundaries of an IP subnet.• The correspondence between subnet masks and IP address ranges follows defined mathematical formulas.• IT professionals use subnet calculators to map between masks and addresses.• A Subnet mask is a 32-bit number that masks an IP address, and divides the IP address into network address and host address.	<p>(Relevant Explanation: 4 marks)</p>



	<ul style="list-style-type: none"> Subnet Mask is made by setting network bits to all "1"s and setting host bits to all "0"s. Within a given network, two host addresses are reserved for special purpose, and cannot be assigned to hosts. The "0" address is assigned a network address and "255" is assigned to a broadcast address, and they cannot be assigned to hosts. Subnet masking for 2 subnet: To calculate the number of subnets or nodes, use the formula $(2^n - 2)$ where n = number of bits in either field, and 2^n represents 2 raised to the nth power. Multiplying the number of subnets by the number of nodes available per subnet gives you the total number of nodes available for your class and subnet mask. Also, note that although subnet masks with noncontiguous mask bits are allowed, they are not recommended. Example: 10001100.10110011.11011100.11001000 140.179.220.200 IP Address 11111111.11111111.11000000.00000000 255.255.192.000 Subnet Mask ----- 10001100.10110011.11000000.00000000 140.179.192.000 Subnet Address Hence Subnet number Address 140.179.64.0 140.179.128.0 																			
	<p>c) Distinguish between guided and unguided transmission media.</p>	<p>4M</p>																		
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	d)	Compare IPV₆ and IPV₄.	4M																				
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5.		Attempt any four :	Marks 16
	a)	Explain RARP and ICMP.	4M
	Ans:	<p>RARP (Reverse Address Resolution Protocol):</p> <ul style="list-style-type: none">• This is used to obtain the IP address of a host based on its physical address.• This performs the job exactly opposite to that of ARP (Address Resolution Protocol)• In RARP, a host in LAN can request to learn its IP address from a gateway server's Address Resolution Protocol (ARP) table or cache.• A network administrator creates a table in a local area networks gateway router that maps the physical machine (or Media Access Control - MAC address) addresses to corresponding Internet Protocol addresses.• When a new machine is set up, its RARP client program requests from the RARP server on the router to be sent its IP address.• Assuming that an entry has been set up in the router table, the RARP server will return the IP address to the machine which can store it for future use. <p>The Internet Control Message Protocol (ICMP):</p> <ul style="list-style-type: none">• ICMP is a error reporting protocol.• This protocol is responsible for providing diagnostic functions and reporting errors due to the unsuccessful delivery of IP packets.• It is used by network devices, like routers, to send error messages indicating, for example, that a requested service is not available or that a host or router could not be reached.• ICMP can also be used to relay query messages.• ICMP enables the detection and reporting of problems in the Internet.	(RARP:2 marks, ICMP: 2 marks)
	b)	Describe repeater. State the situation under which repeater are necessary in network.	4M
	Ans:	<p>Repeater</p> <ul style="list-style-type: none">• Repeaters are used to take the distorted, weak and corrupt input signal and regenerate this signal at its output.• It ensures that the signals are not distorted or weak before it reaches the destination.• It recreates the bit pattern of the signal, and puts this regenerated signal back on to the transmission medium• It works in the physical layer with no intelligent function.• It simply recreates the bit pattern of the signal and puts this regenerated signal back on to the transmission medium. In effect, the original signal is created once again. <p>Example situation in which repeater is used:</p> <p>Repeater is used to remove attenuation in the media, In any computer network, when the data bit pattern is sent from a computer A to Computer B, if Computer B is not able to receive the exact data bit pattern, a repeater is connected in between. This will regenerate the weak signal so that the exact replica of the original input signal is sent forward.</p>	(Repeater : 2marks, Any suitable Situation: 2 marks)

	<p>Diagram:</p> <div style="text-align: center; border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> </div>	
c)	Explain microwave link with diagram.	4M
Ans:	<p>Microwave link :</p> <ul style="list-style-type: none"> • Microwaves use the line of sight method of propagation, as the signals do not travel along the surface of the earth. • Thus, two antennas must be in a straight line, able to see each other without any obstacle in between. • The taller the antenna, the more distance that these waves can travel. Thus, they are always positioned at higher levels like on mountains. • Microwave signals travel only one direction at a time. • Thus for two way communication like telephone systems, two frequencies are allocated. • At both ends, a transceiver is used which is a combination of a transmitter and receiver, operating at two respective frequencies. • Therefore only one antenna can server both the functions and cover both the frequencies. • Repeaters are used along with the antennas to enhance the signal. • The data rates defined are 1Mbps to 10Gbps. <div style="text-align: center; border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> </div>	<p>(Explanation: 3marks, Any suitable Diagram: 1mark)</p>



	d)	Compare hub and switch.	4M																											
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	e)	Explain structure of IP frame header.	4M																											
	Ans:	<p>{**Note: IPv4 or IPv6 packet header shall be considered as the answer for IP frame header. **}</p> <p>IPv4 header:</p> <p>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.</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 15%;">Version (4 Bits)</td> <td style="width: 15%;">HLEN (4 bits)</td> <td style="width: 20%;">Service Type (ToS) (8 Bits)</td> <td colspan="2" style="width: 50%;">Total Length (16 bits)</td> </tr> <tr> <td colspan="3">Identification (16 bits)</td> <td style="width: 15%;">Flags (3bits)</td> <td style="width: 15%;">Fragmentation offset (13 bits)</td> </tr> <tr> <td colspan="2">Time to Live (TTL) (8 bits)</td> <td>Protocol (8 bits)</td> <td colspan="2">Header Checksum (16 bits)</td> </tr> <tr> <td colspan="5">Source IP address (32 bits)</td> </tr> <tr> <td colspan="5">Destination IP address (32 bits)</td> </tr> </table>	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)					(Diagram: 2marks, Explanation: 2marks)		
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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 field size is 2 bytes or 16 ($2^{16} = 65,536$).

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 field 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.

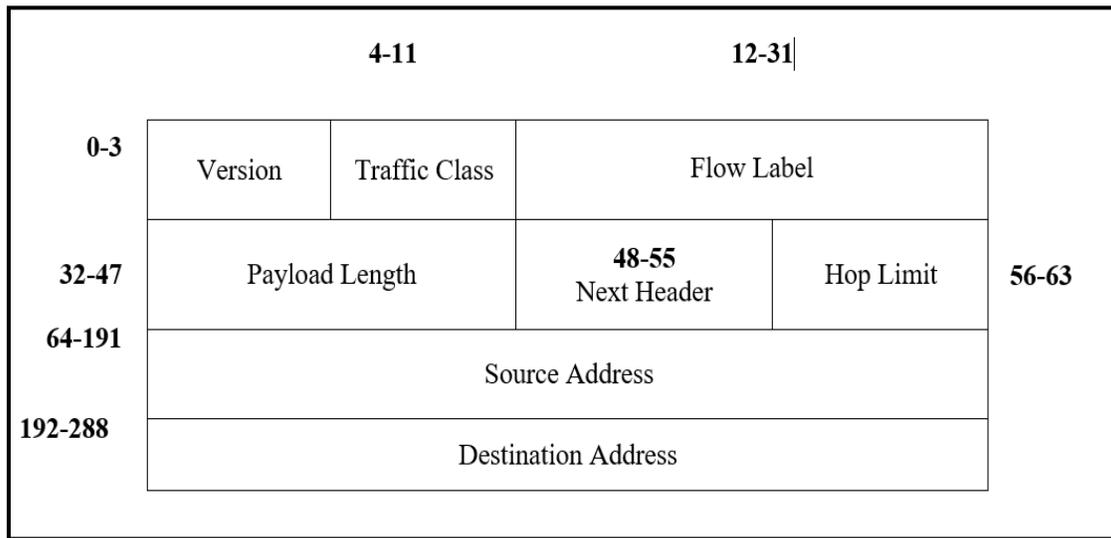
Source address: This field contains the 32 bit IP address of the sender.

Destination address: This field contains the 32 bit IP address of the final destination.

OR

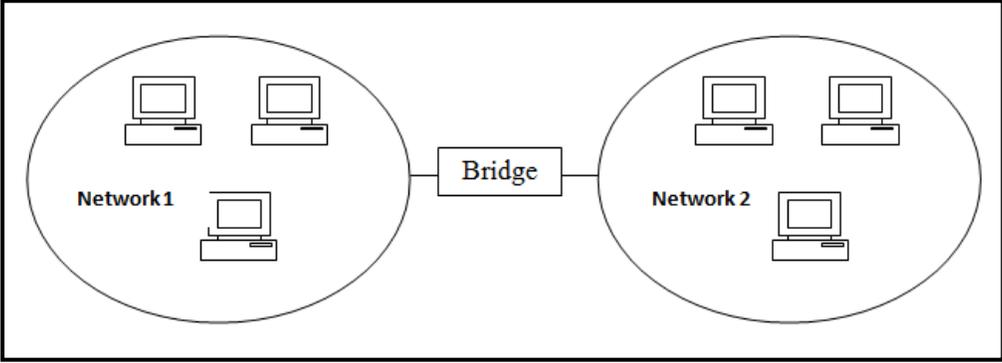


IPv6 header:



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.

	f) Draw and explain working of bridges.	4M
	<p>Ans: Bridge:</p> <ul style="list-style-type: none"> • It is a device which connects two or more segment of a network. • It only forwards the packet which are for the exact destination. • A bridge device filters data traffic at a network boundary. • Bridges reduces the amount of traffic on a LAN by dividing it into two segments. • It inspects incoming traffic and decides whether to forward or discard it. • It sends packets between two networks of same type. • A bridge operates in both the physical and the data link layer. • As a physical layer device, it regenerates the signal it receives. • As a data link layer device, the bridge can check the physical (MAC) addresses (source and destination) contained in the frame. <div style="text-align: center;">  </div>	<p>(Any relevant diagram:2 marks, Explanation:2marks)</p>
6.	Attempt any two :	Marks 16
	a) Explain working of data link layer and network layer of OSI model.	8M
	<p>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 & give back to network layer the way it has taken. IEEE has divided data link layer into two sub layers</p> <p>1) Logical link control (LLC)</p> <p>2) Media access control (MAC)</p> <p>Working:</p> <ul style="list-style-type: none"> • It is responsible for transmitting group of bits between the adjacent nodes. • The group of bits is called as frame. • The network layer passes a data unit to the data link layer. Header and trailer information is added to the data unit by data link layer. • This data unit is passed to the physical layer. • Data link layer is responsible for moving frames from one node to the next. <p>Functions of data link layer include Framing, Physical addressing, Flow control, Error control, Media access control, Node to node delivery.</p>	<p>(Data Link Layer: 4 marks, Network Layer: 4 marks)</p>

	<p>Network layer:</p> <ul style="list-style-type: none"> It is responsible for routing the packets within the subnet i.e. from source to destination. It is responsible for source to destination delivery of individual packets across multiple networks. It ensures that packet is delivered from point of origin to destination. <p>Working:</p> <ul style="list-style-type: none"> Network layer chooses a route before sending all the packets belonging to the same message. A header is added to a packet, which includes source and destination addresses. Any congestion at a node is tackled by the network layer. When there are multiple subnet operators of different types, the different rates are charged by the network layer as an accounting function. Functions of network layer include Logical addressing, Routing, Congestion control, Accounting and billing, Address transformation and Source host to destination host error free delivery of packet. 	
b)	What is ARP? Explain function of ARP.	8M
Ans:	<ul style="list-style-type: none"> ARP stands for Address Resolution Protocol. ARP converts an Internet Protocol address to its physical network address (MAC). ARP was defined by RFC 826 in 1982. It operates at layer 2 of the OSI model. <p>Diagram:</p> <div style="text-align: center;"> <p>The diagram illustrates the ARP process in two parts. In the first part, System A sends a 'Request' (broadcast) to find the physical address of a node with IP address 141.23.56.23. The broadcast reaches System B. In the second part, System B sends a 'Reply' containing the physical address A4:6E:F4:59:83:AB back to System A.</p> </div> <p style="text-align: center;">Fig: ARP Operation</p>	<p>(ARP Definition: 2 marks, Diagram: 2 marks, Any 4 Functions of ARP: 1 mark each)</p>



	<p>Functions:</p> <ul style="list-style-type: none">• Local host maintains the ARP Table. ARP maps the Internet Protocol address (IP) to a physical machine address.• It provides the interface between the IP addressing system used by IP and the Hardware addresses used by the data link layer protocol.• ARP broadcasts an IP address in an effort to discover its equivalent hardware address.• ARP has been implemented with many combinations of network and data link layer technologies.• Responsible for ARP query and ARP response datagram.• Maintains ARP cache so that if the same query has been processed earlier, new broadcast message is not created but, it checks in the ARP cache.	
	<p>c) Describe advantages and disadvantages of optical fiber cable.</p>	<p>8M</p>
<p>Ans:</p>	<p>Optical fibre advantages:</p> <ul style="list-style-type: none">• Higher bandwidth : Fiber-optic cable can support dramatically higher bandwidths (and hence data rates) than either twisted-pair or coaxial cable• Less signal attenuation: Fiber-optic transmission distance is significantly greater than that of other guided media. A signal can run for 50 km without requiring regeneration.• Immunity to electromagnetic interference: Electromagnetic noise cannot affect fiber-optic cables.• Resistance to corrosive materials: Glass is more resistant to corrosive materials than copper.• Light weight: Fiber-optic cables are much lighter than copper cables.• Greater immunity to tapping: Fiber-optic cables are more immune to tapping than copper cables. Copper cables create antenna effects that can easily be tapped.• Lesser number of repeaters• Electrical isolation: - Optical fibres are fabricated from glass or plastic polymers which are electrical insulators. Hence they do not exhibit earth loop.• Signal security: - The light from Optical fibre does not radiate significantly & therefore they provide a high degree of signal security. <p>Optical fibre disadvantages:</p> <ul style="list-style-type: none">• Installation: Not easy to install.• Maintenance: Its maintenance require expertise.• Unidirectional light propagation: Propagation of light is unidirectional. Two fibers are needed for bidirectional communication.• Cost: The cable and the interfaces are relatively more expensive than those of other guided media. If the demand for bandwidth is not high, often the use of optical fiber cannot be justified.	<p>(Any 4 Advantages :1 mark each, Any 4 Disadvantages: 1 mark each)</p>