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.1.

(A) Attempt any SIX :   **12**

(a) Define Server. Give the name of any two types of Server.
(Definition -1 mark, any two types -1 mark)

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.
Types of server:
1. File server
2. Print Sever
3. Application server
4. Message server
5. Database server

(b) Define LAN. Write any two disadvantages of LAN.
(Definition 1 mark, any 2 disadvantage -1 mark)
 Definition of LAN: LAN is a network which is designed to operate over a small physical area such as an office, factory or a group of buildings.
Disadvantages:
1. Power - a good LAN is required to be on all the times.
2. Security - each computer and device become another point of entry for undesirables.
3. Investment in Higher Costs due to server systems.
4. Frustration if having a problem setting up.
5. A lot of times a network shares one Internet connection - if all computers running at once, can reduce speed for each.
6. Area covered is limited.

(c) Write in brief any two roles of network control devices in computer network.
(1 role – 1 mark, any 2 two roles)
Two roles of network control devices in computer:
Role of repeater: Generates the original signal. Operates in the physical layer.
Role of Bridges: Bridges utilize the address protocol. They can exercise the traffic management. They are most active in the data link layer.
Role of routers: Routers provide connections between two separate but compatible networks. It works in the network layer.
Role of Gateways: Gateways provide translation services between incompatible networks and works in all layers.

(d) List any two disadvantages of bus topology.
(1 disadvantage- 1mark, any two disadvantages)
Disadvantages of bus topology.
1. Heavy network traffic slows down the bus speed .In bus topology only one computer can transmit & other have to wait till their turn comes & there is no co-ordination between computers for reservation of transmitting time slot.
2. The BNC connector used for expansion of the bus attenuates the signal considerably.
3. A cable break or loose BNC connectors will cause reflections & bring down the whole network causing all network activity to stop.

(e) Define Wi-Max. (definition 2 marks)
Define: Wi- Max is worldwide interoperability for Microwave Access. It is a wireless communication standard which can provide data rates up to 1 Gbps.

(f) Give any two disadvantages of unshielded twisted pair cable.
(1 disadvantage- 1mark, any two disadvantages)
Disadvantages of unshielded twisted pair cable.
1. Highly prone to crosstalk.
2. Unable to provide secured transmission of data.

(g) Define protocol. Give the name of any two protocols.
(Definition -1 mark, any two examples- 1 mark)
 Define protocol: There are certain rules that must be followed to ensure proper communication & a set of such rules is known as protocol.
Example: UDP, TCP/IP, SMTP, HTTP, SSL, FTP etc

(h) List different classes of IP Address.
(½ mark for each class, Any four classes)
Different classes of IP address.
Class A
Class B
Class C
Class D
Class E

(B) Attempt any TWO :   **8**

(a) Compare Server based network and peer-to-peer network. (Any four points)
(Each difference 1 mark, any four points)
Compare Server based network & Peer to Peer network

Server based network	Peer to Peer
1. It is much like company uses centralized management.	1. It is much like company uses decentralized management.
2.In this server has more power & client has less power.	2.In this each machine has same power
3. It is hardware intensive.	3. Uses less expensive computer hardware.
4. Complex to setup & require professional administrator.	4. Easy to setup & administrator.
5.Very secure	5.Less secure
6.Network O.S required	6.Network O.S not required
7.It support large Network	7.It support small Network
8.Better performance	8.Might hurt user's performance

(b) Give any four selection criteria for selecting network topology.
(1- mark for each criteria, any four criteria)
Selection criteria for selecting network topology.

1. Size of the network & number of devices or nodes being connected.
2. Ease of configuration & installing.
3. The ease of adding new device in an existing network.
4. The ease of fault indication & reflection.
5. Number of physical   links required to be used for connecting the devices.
6. Need of network connecting devices such as repeaters, switches, hubs etc.
7. Costs involved.
8. Need of security.
9. Need of network administration.

(c) Discuss hybrid topology with suitable diagram.
(Explanation -2 marks, Diagram- 2 marks)
Discuss hybrid topology with suitable dig.
Hybrid topology is one that uses two or more basic topologies together Fig.1 depicts this. In this case, the bus, star & ring topologies are used to create this hybrid topology. There are multiple ways in which this can be created. The hybrid topology which is to be used for a particular application depends on the requirements of that application. In practice, many networks are quite complex but they can be reduced to some form of hybrid topology.
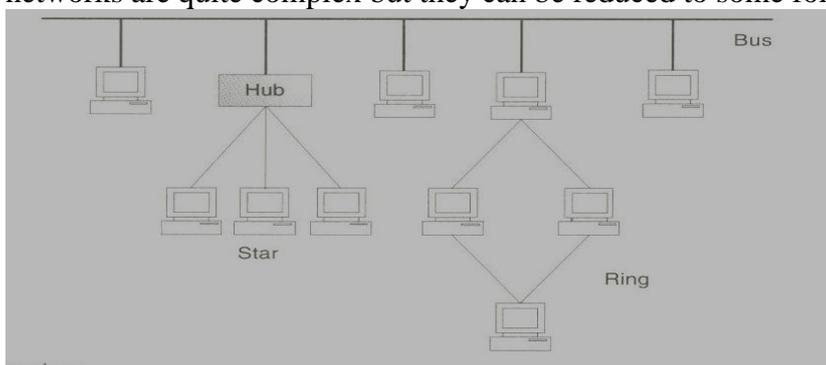
Q.2   Attempt any FOUR: 16

a) **Enlist eight applications of computer network.**
   (½ marks for each application, any eight applications)

Applications of Compute Network
1) Banking
2) Video conferencing
3) Marketing
4) School
5) Radio
6) Television
7) E-mail
8) Companies
   OR

1. Sharing the resources such as printers among all the users.
2. Sharing of expensive software & hardware.
3. Communication from one computer to other.
4. Exchange of data & information amongst the users, via the network.
5. Sharing of information over the geographically wide areas.
6. For connecting the computers between various buildings of an organisation.
7. For educational purposes.
8. Maintenance is limited to the servers & clients.

b) **Compare LAN, MAN and WAN. (Any four points)**
   (1 mark for each point, any four comparison points)

LAN	MAN	WAN
1. Area – Network within a single building or campus of up to a few kilometres in size. 10 … 1 Km campus.	1.Area-Network within over an entire city. Up to 10km	1.Area – Network spans a large geographical area after a country or continent 100 km …1000km country ….continent
2. LAN network has very high speed mainly due to proximity of computer and network devices.	2.MAN network has lower speed compared to LAN.	2.WAN speed varies based on geographical location of the servers. WAN connects several LANs
3. Bandwidth is low.	3. Bandwidth is moderate.	3 Bandwidth is high.
4. Transmission media – coaxial cable.	4.Transmission media-cables, PSTN, optical fibre cables, wireless	4 Transmission media – PSTN or Satellite links.
5. Data rate is high.	5. Data rate is moderate.	5. Data rate is low.

c) **Draw and explain Co-axial cable.**
   (Diagram 1 mark,explaination 1 mark,any 2 advantages & disadvantages 1 mark each)
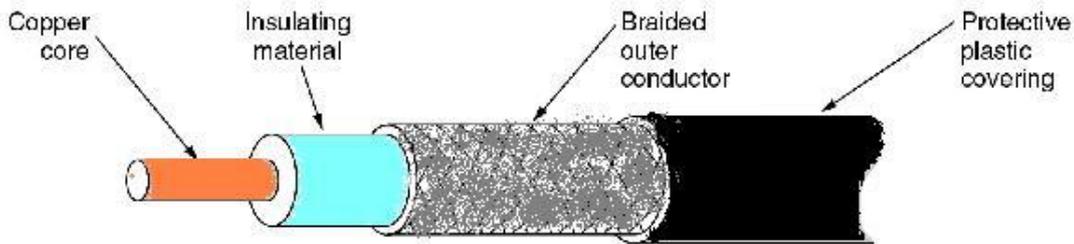
Coaxial cable (also called as coax) has an inner central copper conductor surrounded by an insulating sheath, which in turn is enclosed in the metal mesh. This outer conductor (shield) acts not only as a second conductor for completing the circuit but also acts as shield against noise. This whole arrangement is enclosed in protective plastic cover as shown in fig.
Co-axial cables are divided into various categories depending upon the thickness & size of the shields, insulators and the outer coating & other considerations. They are commonly used by cable companies to carry cable transmissions. The various coaxial cable standards are RG-8, RG-9,RG-11,RG-58 and RG-59.
Advantages of coaxial cable are:-
   1.it carries signals of higher frequency ranges than twisted pair cable.
   2.lower attenuation than twisted pair cable.
   3. supports higher bandwidth.

Disadvantages of coaxial cable are:-
   1.Cost of coaxial cable is more than twisted pair cable.
   2.Less flexible .
   3. More difficult to install in a building where a number of twists and turns are required.
   4. limited to size of network.

d) **State the factors to be considered for selecting transmission media. (Eight   points)**
   ($^{1/2}$ marks for any eight factors)

   Eight factors to be considered:
      1. Type of medium.
      2. No of conductors/connectors.
      3. Flexibility.
      4. Durability.
      5. Bandwidth.
      6. Reliability of connection
      7. Required speed
      8. Distance
      9. Ease of installation and maintenance access
      10. Technical expertise required to install and utilize
      11. Resistance to internal EMI , cross talk of parallel wires
      12. Resistance to external EMI outside the cable.
      13. Attenuation characteristics
      14. Cost

e) **Discuss any four network features.(1 mark for each feature, any four features)**
Discuss any four network features.

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.

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.

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 mush faster & more convenient.

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.

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.

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.

7) Network security: Internal & External

f) **Explain infrared communication. List any two disadvantages of infrared communication.(explanation -2 marks, Two disadvantages -2 marks)**
Infrared communication (IR) is an example of wireless communication. However, it is limited to very simple applications & suffers from several disadvantages, mainly very small bandwidth & distances that it can support. Infrared communication works in the micrometer range, which is 1 to 430 THZ. The term **infrared** comes from the fact that red color has the longest wavelength amongst the colors in visible light. However, the wavelength of infrared

is longer than that of red color, and hence the frequency of infrared communications is smaller than that of red color. Hence, we have the term 'below red color' or 'Infrared'.

Infrared communication is used by military for surveillance, for vision in the darkness at night, tracking objects, etc. We use infrared communication whenever we use our remote controls to operate television sets, DVD players, etc. Weather forecasting & astronomy also make use of infrared communication.

Disadvantage:

i. The major disadvantage is that the sun generates radiation in the infrared band. This can cause a lot of interference with IR communication.
ii. Infrared signals cannot penetrate walls
iii. Large areas require multiple emitter panels, which will increase the cost of the system.

Q.3.   **Attempt any FOUR: 16**
   a)   **Explain PAN with suitable diagram. Differentiate between PAN and CAN.   (Two points only)**
   (diagram- 1 mark,Explanation-1 mark, differentiation-any 2 points-1 mark each)
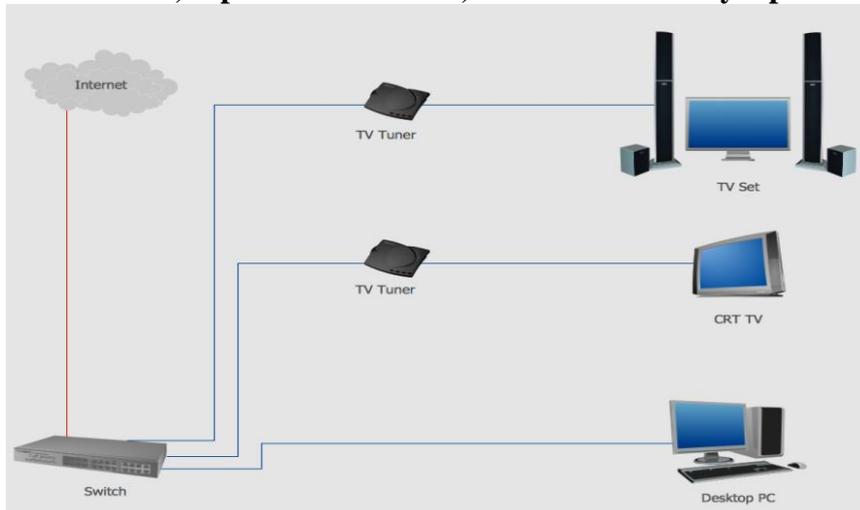
A personal area network(PAN) is a network organized around an individual person. A PAN can also be used for communication among personal devices themselves(interpersonal communication).PAN network can be constructed using cables or it can be wireless. A personal area network (PAN) is the interconnection of information technology devices within the range of an individual person, typically within a range of 10 meters. For example, a person traveling with a laptop, a personal digital assistant (PDA), and a portable printer could interconnect them without having to plug anything in, using some form of wireless technology. Typically, this kind of personal area network could also be interconnected without wires to the Internet or other networks.

PAN	CAN
1. PAN is definitively the smallest type of network you can currently use and the name comes from Personal Area Network	1. This is a network spanning multiple LANs within a limited geographical area.
2. PAN is the interconnected network of technologic devices within the reach of an individual	2.It can connect different buildings in its campus such as various departments, library etc.

person.	
3. Range of maximum 10 meters.	3. The range of CAN is 1KM to 5KM
4. PAN is mainly used for personal communication.	4. CAN is mainly used for corporate campuses.

b) Discuss the role of the HUB. Differentiate between Active Hub and Passive Hub. (Role-2 marks, difference any 2 points -1 mark each)

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
2) Active
3) Intelligent

Active Hub	Passive Hub
1. They are like passive hubs but have electronic components for regeneration and amplification of signals.	1. A passive hub simply combines the signals of a network segments.
2. by using active hubs the distance between devices can be increased.	2. A passive hub reduces the cabling distance by half because it does not boost the signals.
3. The main drawback of active hubs is that they amplify noise along with the signals.	3. Passive hubs do not amplify noise.
4. They are much expensive than passive hubs.	4. They are not much expensive.

c) **Why layered architecture is used in OSI reference model? Discuss.**
 (Explanation-3 marks, diagram 1 mark)
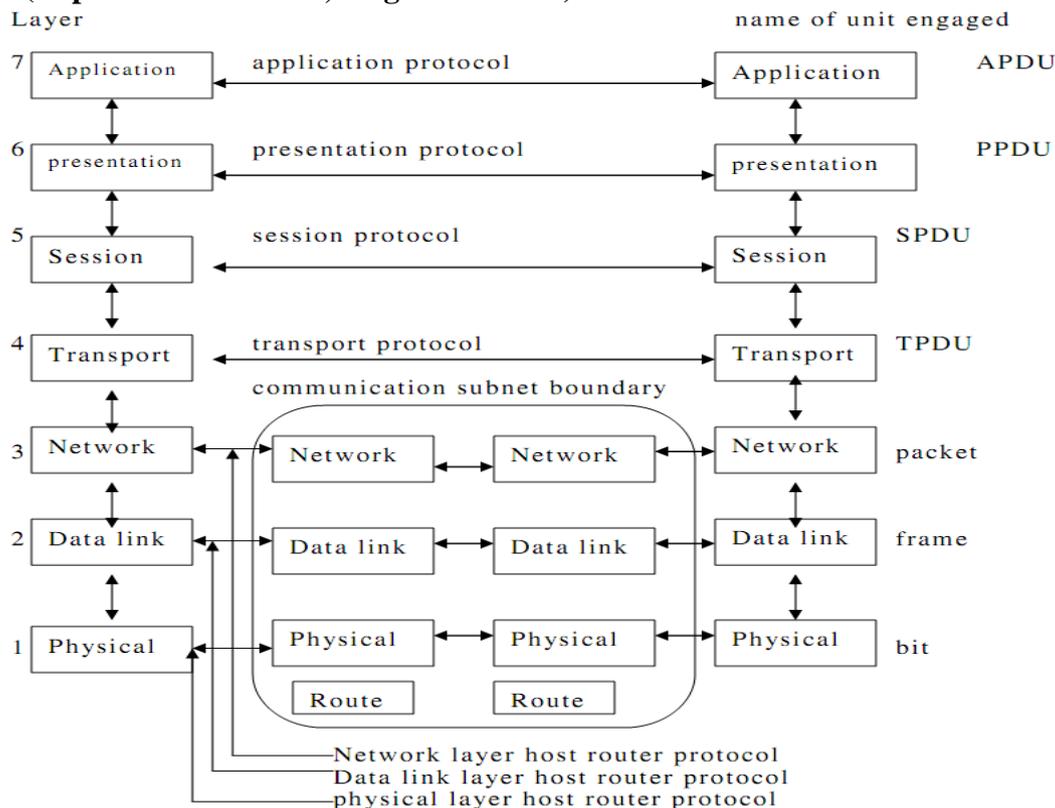
The OSI reference model is as shown in the figure. There are seven layers in the model. Physical layer, Data link layer, Network layer, Transport layer, Session layer, Presentation layer, Application layer. Each layer performs unique and specific task and it offers services to the layer above it. Each computer on a network uses a series of protocols to perform the functions assigned to each layer. At the top of the stack is the application layer and at the bottom is the physical medium which actually connects the computers to form a network. The figure shows the OSI model with two hosts A and B, communicating with each other

Interface: an interface defines the operations and services offered by lower layer to the upper layer. This is an interface between each pair of adjacent layers as shown in the figure.

Peer: the entities comprising the corresponding layers on different machines are called as peers. The communication actually takes place between the peers using the protocols.

Exchange of information: at the physical layer the communication is direct that is, machine A sends a stream of bits to machine B. at higher layers each layer in the sending machines adds its own information to the message it receives from the layer just above it and passes the whole package to the layer just below it. The information added by each layer is in the form of headers or trailers. At layer 1 the entire package is converted to a form that can be transferred to the receiving machine.

d) Explain encapsulation with example. (Diagram 1 mark, explanation 1 mark, example 2 mark)
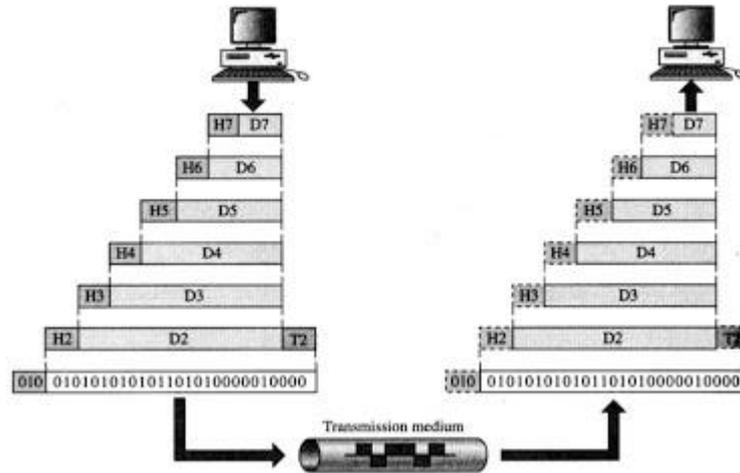
Each layer in the layered architecture provides service to the layers which are directly above and below it. The outgoing information will travel down through the layers to the lowest layer. While moving down on the source machine, it acquires all the control information which is required to reach the destination machine. The control information is in the form of headers and footers which surrounds the data received from the layer above. This process of adding headersand footers to the data is called as data encapsulation. The headers and footers contain control information in the individual fields. it is used to make message packet reach the destination. The headers and footers form the envelope which carries the message to the desired destination.

Eg:

DATA ENCAPSULATION IN SENDING MACHINE
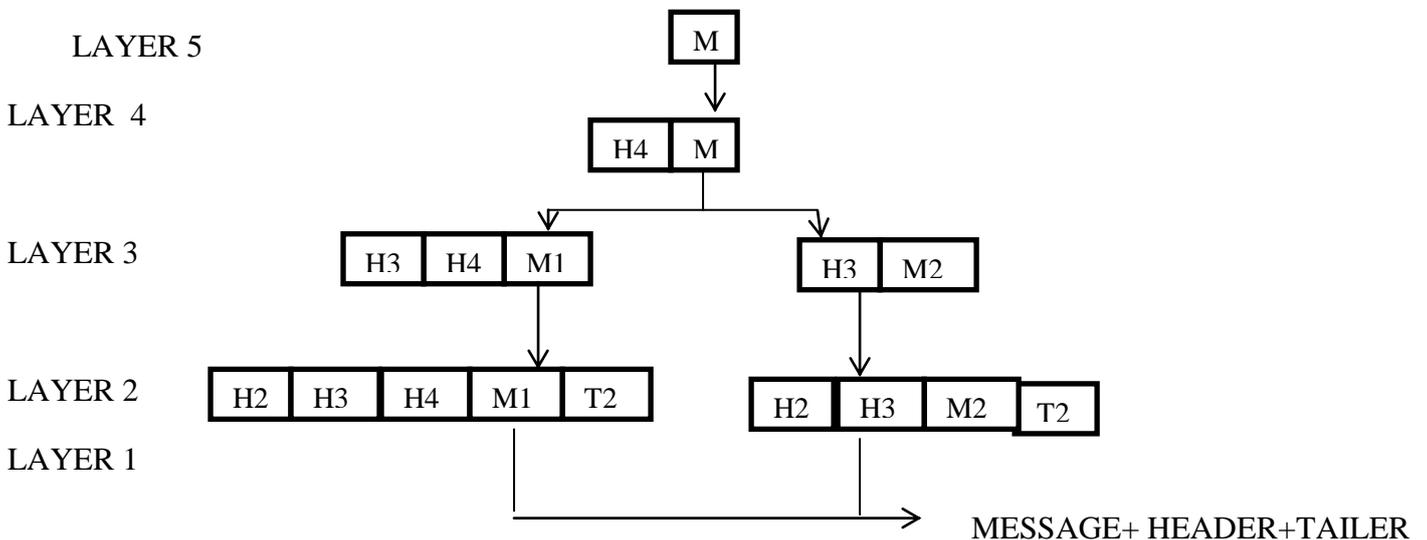

H4 = LAYER 4 HEADER

H3 = LAYER 3 HEADER
H2 = LAYER 2 HEADER
T2 = LAYER 2 TAILER

REVERSE PROCESS AT THE DESTINATION MACHINE

LAYER 5

LAYER 4

LAYER 3

LAYER 2

LAYER 1

MESSAGE+ HEADER+TAILER
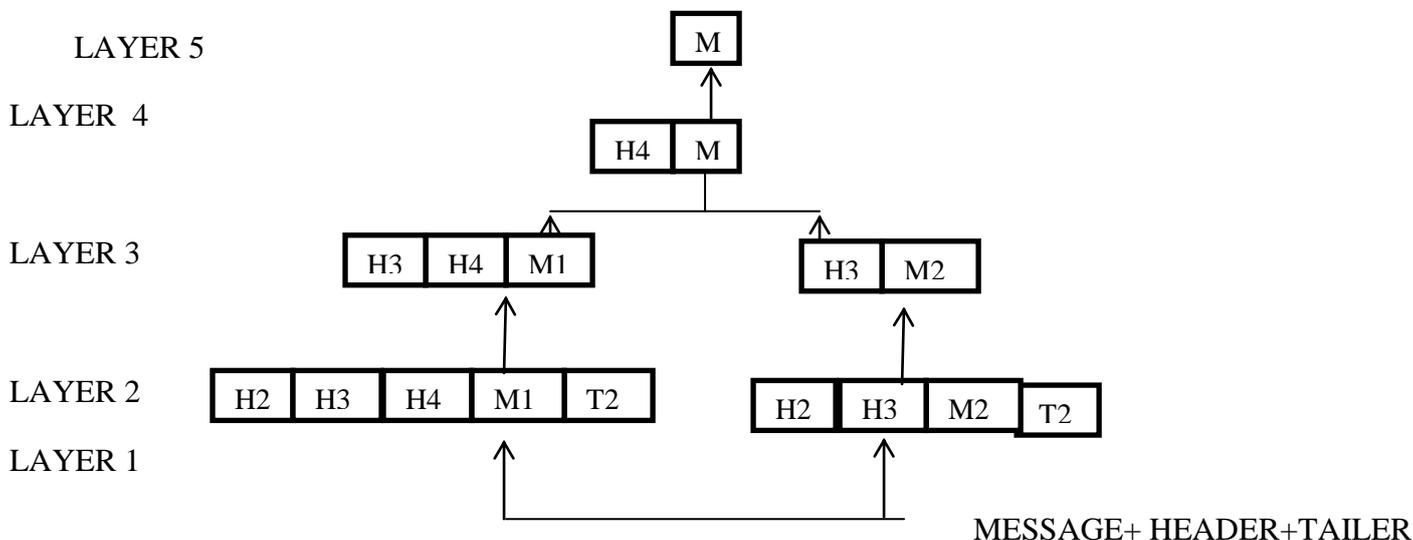
H4 = LAYER 4 HEADER
H3 = LAYER 3 HEADER
H2 = LAYER 2 HEADER,T2 = LAYER 2 TAILER

The figure shows the example of five layer stack for data encapsulation. The fifth layer of sending machine wants to send a message M to the fifth layer of destination machine. The message M is produced by layer 5 of machine 1 and given to layer 4 for transmission. Layer 4 adds header H4 in front of the message and pass it to layer 3. Layer 3 breaks up the incoming message into small units as M1 and M2 and pass these packets to layer 2. Layer 2 adds the header as well as footer to each packet obtained from layer 3 and pass it to layer 1 for physical transmission.

e) **Write the name of layers that perform the following functions in OSI :**

I. **Data Encryption**
II. **Error Correction**
III. **File Transfer**
IV. **Data Encoding**

(1 mark each)
1. **Data Encryption**-Presentation Layer
2. **Error Correction**-Data link layer and Transport layer
3. **File Transfer**-Application layer
4. **Data Encoding**-Presentation layer

f) **Explain the services provided by transport layer in TCP/IP model.**
(Any four functions 1 mark each)

Responsibility of process to process delivery of message
Ensure that whole message arrives in order.

1. Service point addressing: -several programs run at a time on computer. Delivery is not only from one computer to another but also from specific process on computer to specific process on another computer. For this transport layer uses port addresses. Transport layer delivers entire message to the correct process on the computer.
2. Segmentation and reassemble: -Each segment of a message contains a sequence number which is used to reassemble the message correctly upon arriving at destination and to identify and replace packets that are lost in transmission.
3. Connection control:-Logical connection is created between source and destination for the duration of complete message transfer.
4. Flow control:-Flow control is performed end to end.
5. Error control:-Error control is performed process to process. It ensures that entire message arrives at receivers transport layer without error(damage or loss or duplication). Error correction is done by retransmission.

Q.4. **Attempt any FOUR: 16**
a) **Explain following protocols:**
I. **PPP**
II. **SLIP**

(2 marks for PPP explanation,2 marks for SLIP explanation)
(i)PPP:-PPP means point to point protocol. It is a much more developed protocol than SLIP(which is why it is replacing it).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).
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.
Data encapsulated in a PPP frame is called a packet. These packets are generally datagrams, but can also be different. so one field of the frame is reserved for the type of protocol to which the packet belongs. The PPP frame looks like:

Data to be Transmitted	**Padding Data**

The padding data is used to adapt the length of the frame for certain protocols.

(ii)SLIP:-SLIP means Serial Line Internet Protocol.SLIP is the result of the integration of modem protocols prior to suite of TCP/IP protocols.
It is a simple internet link protocol conducting neither address nor error control. Data transmission with SLIP is very simple. this protocol sends a frame composed only of data to be sent followed by an end of transmission character(the END character, the ASCII code of which is 192).A SLIP frame looks like:

Data to be Transmitted	**END**

b) Compare IPv4 and IPv6. (Any four points)
   (any 4 points,1 mark each)

IPv4	IPv6
1. Source and destination addresses are 32 bits (4 bytes) in length.	1. Source and destination addresses are 128 bits(16 bytes) in length.
2. Uses broadcast addresses to send traffic to all nodes on a subnet.	2. There are no IPv6 broadcast addresses. Instead, multicast scoped addresses are used.
3. Fragmentation is supported at originating hosts and intermediate routers.	3. Fragmentation is not supported at routers. It is only supported at the originating host.
4. IP header include a checksum.	4. .IP header does not include a checksum.
5. IP header includes options.	5. All optional data is moved to IPv6 extension headers.
6. IPsec support is optional	6. IPsec support is required in a full IPv6 implementation.
7. No identification of payload for QoS handling by routers is present within the IPv4 header.	7. Payload identification for QoS handling by routers is included in the IPv6 header using the Flow Label field.
8. Address must be configured either manually or through DHCP.	8. Addresses can be automatically assigned using stateless address auto configuration, assigned using DHCPv6, or manually configured.
9. Uses host address(A) resource records in the domain name system to map host names to IPv4 addresses.	9. Uses host address (AAAA) resource records in the domain name system to map host names to IPv6 addresses

c) Draw and explain fiber optic cable.(2 marks for diagram, 2 marks for explanation)
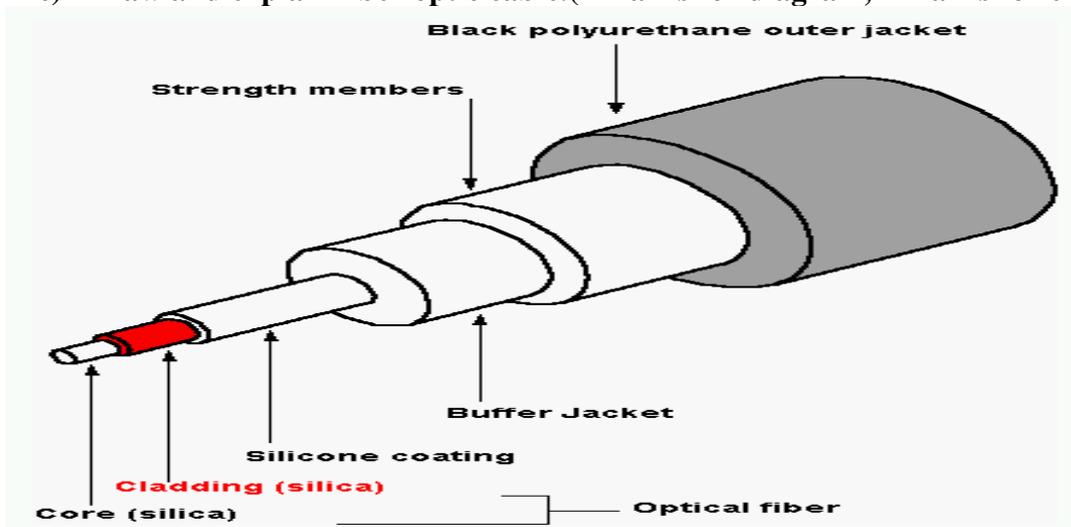
As shown in the figure, at the center is the glass core through which the light propagates. In multimode fibers, the core is typically 50 microns in diameter. In single mode fibers, the core is 8 to 10 microns. The core is surrounded by a glass cladding with a lower index of refraction than the core, to keep all the light in the core. A thin plastic jacket is used to protect the cladding. Fibers are grouped in bundles, protected by an outer sheath.

Fibers can be connected in three different ways. First they can terminate in connectors and be plugged into fiber sockets. Connectors lose about 10 to 20 percent of the light, but they make it easy to reconfigure systems.

Second they can be spliced mechanically. Mechanical splices just lay the two carefully – cut ends next to each other in a special sleeve and clamp them in place. Alignment can be improved by passing light through the junction and then making small adjustments to maximize the signal.

Third, two pieces of fiber can be fused to form a solid connection. A fusion splice is almost as good as a single drawn fiber.

d) Explain sub-netting and super-netting with example.

(Sub-netting 2 marks, super-netting 2 marks)
Sub-netting:subnet mask is a net mask with the only real difference being that breaking a larger network into smaller parts and each smaller section will use different sets of address numbers. The subnet mask is 32 bit value that usually express in dotted decimal notation used by IP address. This is the combination of net-ID and host-ID.
Example:
Consider the subnet mask as 255.255.0.0.
convert the 255.255.0.0 subnet mask to binary.
255.255.0.0 =
11111111 11111111 00000000 00000000
(in binary)
add 1s right after the last 1 on the right (in the middle of the mask, between the 1s and 0s)
 I add five 1s to make it look like this:
11111111 11111111 11111000 00000000
Using the subnet's formula, this would give us 25 = 32 networks
Super-netting:
To create a supernetwork, the procedure is to be reversed.Th networks are combined by creating space for a larger number of hosts. To accomplish this, we start with the default subnet mask of 255.255.255.0 and use some of the bits reserved for the Netid to identify the Hostid. The following exampleshows we would create a new supernetwork by combining four separate subnetworks.

Example: If a packet arrives at the router with the destination address 192.168.64.48, the supernet mask 255.255.252.0 is applied to the destination address.
11000000.10101000.01000000.00110000 (destination IP address)

AND
11111111.11111111.11111100.00000000 (supernet mask)

Returns
11000000.10101000.01000000.00000000

e) **Explain horizontal and vertical communication. (2 M each)**
   Horizontal communication
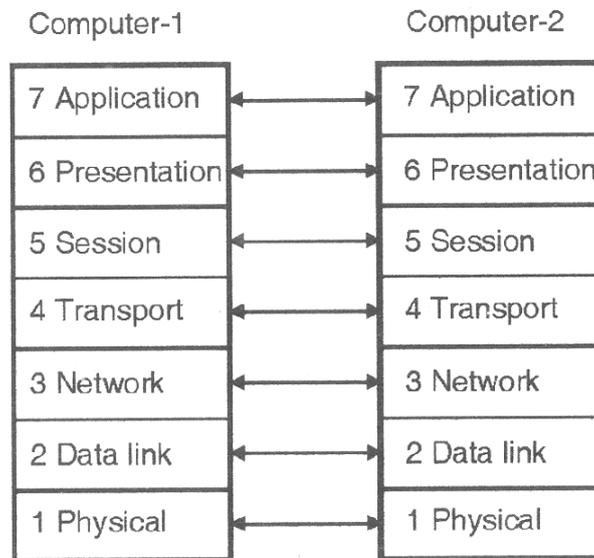

Fig: Horizontal Communication in OSI Model.

1) The horizontal communication is the logical connection between the layers, there is no direct communication between them.
2) Information included in each protocol header by the transmitting system is a message that will be carried to the same protocol in the destination system .
3) For two computers to communicate over a n/w, the protocol used at each layer of the OSI model in the transmitting system must be duplicated at the receiving system.
4) The packet travels up through the protocol stack and each successive header is stripped of by the appropriate protocol & processed.
5) When the packet arrived at its destination, the process by which the headers are applied at the source is repeated in server.

   Vertical communication:
1) In addition to communicating horizontally with the same protocol in the other system, the header information also enables each layer to communicate with the layer above & below it.
2) Eg. The n/w layer will communicate with the data link layer & transport layer.

3) This interlayer communication is called communication vertical.
4) When a system receives a packet & passes it up through various layers the data link layer protocol header includes a field which specifies the name of n/w layer protocol to be used to process the packet.
5) The n/w layer protocol header will specify the name of transport layer protocol to be used to process the packet.
6) Due to vertical communication, it becomes protocol at each layer simultaneously.
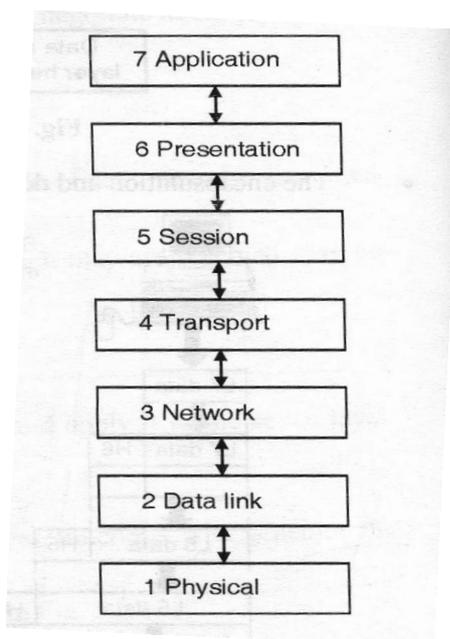
Fig:Vertical communication

f) **Enlist the components of computer network. Describe any one in brief.**
(1 mark for list, 3 marks for description, any other component can be considered)
The components of computer network are:

* Hub
* Router
* Modem
* Bridge
* Switches
* Network Interface Card
* Cables and connectors
* Crimping tool
* LAN tester

Explanation:

1)   **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
2) Active
3) Intelligent
Passive Hubs: A passive hubs simply combines the signals of a network segments. There is no signal processing or regeneration. Apassive hub reduces the cabling distance by half because it does not boost the signals and in fact absorbs some of the signal. With the passive hub each computer receives the signal sent from all the other computers connected to the hub.

Active hubs: They are like passive hubs but have electronic components for regeneration and amplification of signals. by using active hubs the distance between devices can be increased. The main drawback of active hubs is that the amplify noise along with the signals. They are also much expensive than passive hubs.

Intelligent hubs: in addition to signal regeneration, intelligent hubs perform some network management and intelligent path selection. One advantage to this is that all transmission media segment can be connected permanently because each segment will be used only when a signal is sent to a device using that segment.
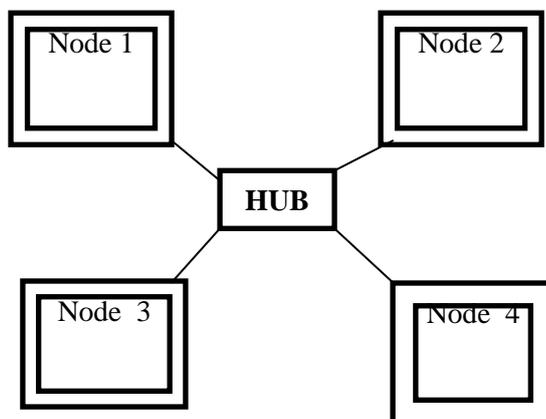
2) **ROUTER:** Router is a device that connects 2 or more networks. It consist of hardware and software .hardware includes the physical interfaces to the various networks in the internetwork. Software in a router is OS and routing protocols management software.

1) Router use logical and physical addressing to connect two or more logically separate networks.

2) They accomplish this connection by organizing the large network into logical network called subnets.

3) Each of the subnet is given a logical address. This allows the network to be separate but still access to each other and exchange data.

4) Data is grouped into packets. Each packet has physical device address and logical network address.
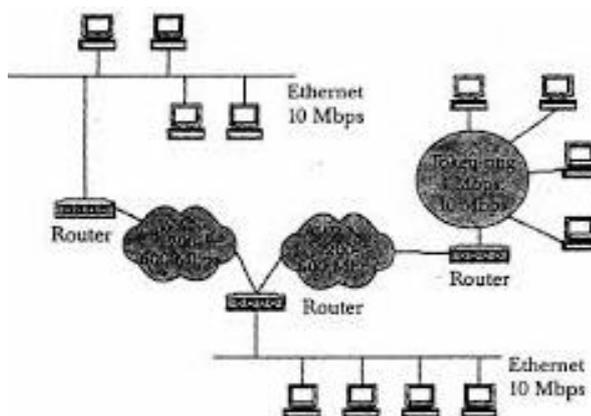
Local area networks connected to the Internet via gateways or routers

3) **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 .it is of analog technology but computer sends digital data to transfer this data to another location it is needed to convert into analog format so that it can be transferred by using currently available infrastructure.
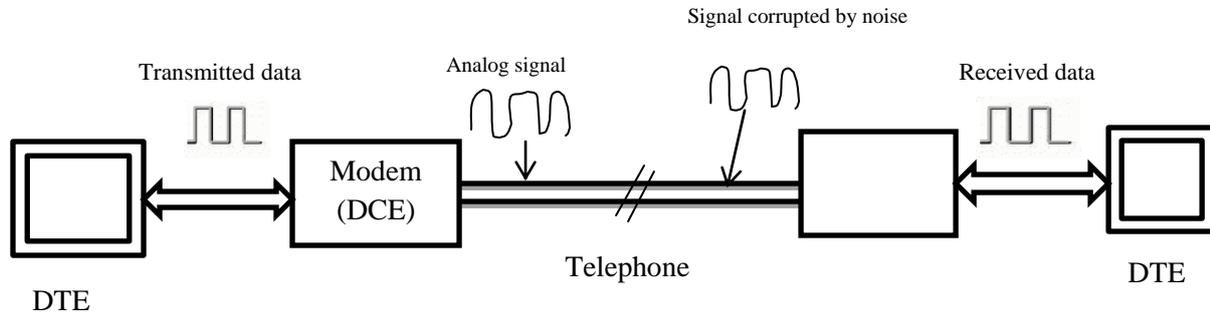
Q.5.   Attempt any FOUR :   16
a) **Compare OSI reference model and TCP/IP network Mode.**
(any 4 points 1 mark for each)

OSI reference model	TCP/IP network model
1)It has 7 layers	1)It has 4 layers
2)Transport layer guarantees delivery of packets	2)Transport layer does not guarantees delivery of packets
3)Horizontal approach	3)Vertical approach
4)Separate presentation layer	4)No session layer, characteristics are provided by transport layer
5)Separate session layer	5)No presentation layer, characteristics are provided by application layer
6)Network layer provides both connectionless and connection oriented services	6)Network layer provides only connection less services
7)It defines the services, interfaces and protocols very clearly and makes a clear distinction between them	7)It does not clearly distinguishes between service interface and protocols
8)The protocol are better hidden and can be easily replaced as the technology changes	8)It is not easy to replace the protocols
9)OSI truly is a general model	9)TCP/IP cannot be used for any other application
10)It has a problem of protocol filtering into a model	10)The model does not fit any protocol stack.

b) **In star topology which device is preferable as a star device between switch and hub? Justify.**

(2 marks for explanation, 2 marks for diagram)
<u>Switch in star Topology:</u>
- Switch is used as a central device to connect different nodes in star topology.
- Switch is an intelligent device. When switch receives a data packet it reads destination address stored in the packet it reads destination address stored in the packet and send it to only that node whose destination address matches with the address contained in the data packet.

Diagram:
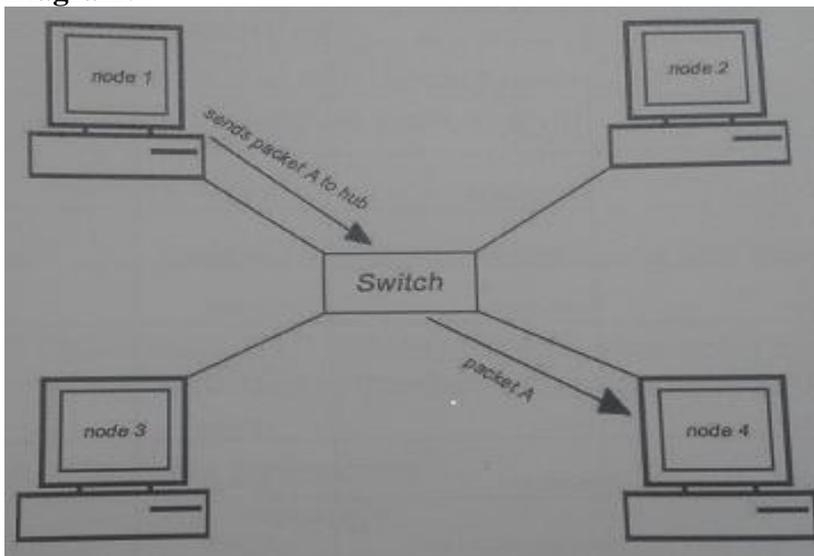
c) **Explain different modes of fibre optic cable.(For each mode 2 marks)**
- Current technology supports two modes for propagating light along optical channels.
1. Multimode.
2. Single mode.
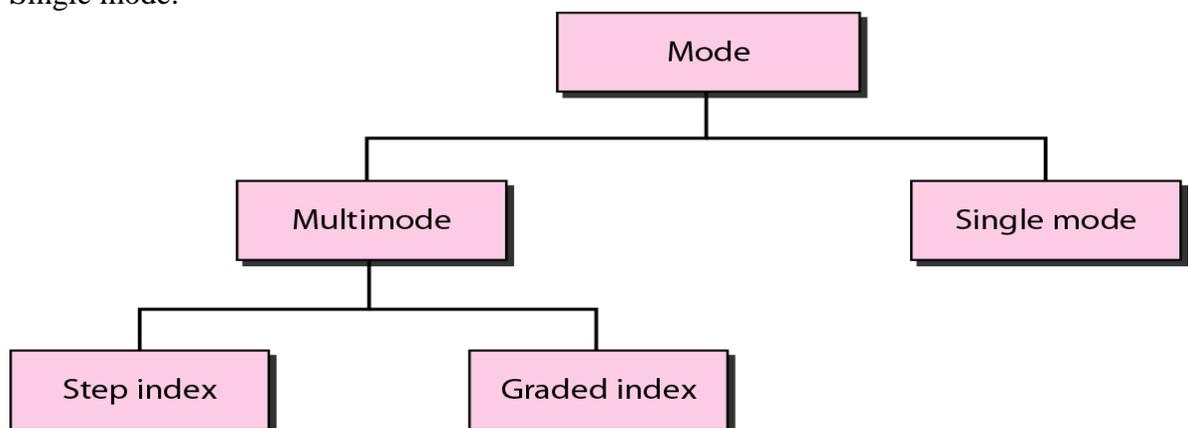
- Multimode can be implemented in two form:
1. Step index.
2. Graded index.

- **Multimode :**
- Multiple beams from a light source move through the core in different paths.
- How these beams move within the cable depends on the structure of the core as shown in the fig.
- In multimode step-index fiber, the density of the core remains constant from the center to the edges.
- A beam of light moves through this constant density in a straight line until it reaches the interface of the core and the cladding.
- At the interface, there is an abrupt change due to a lower density, this alters the angle of the beam's motion.
- The term step index refers to the suddenness of this change, which contributes to the distortion of the signal as it passes through the fiber.
- A multimode graded index fiber decreases this distortion of the signal through the cable.
- In this, density is highest at the center of the core and decreases gradually to its lowest at the edge.
- Following fig shows the impact of this variable density on the propagation of light beams.
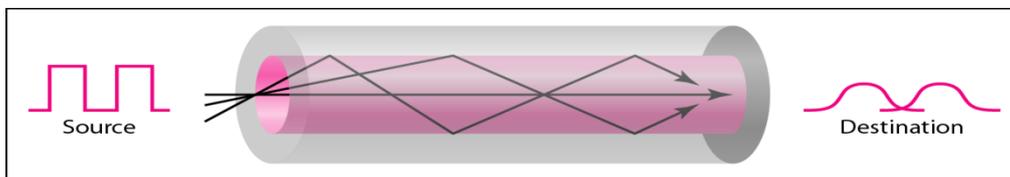
a. Multimode, step index
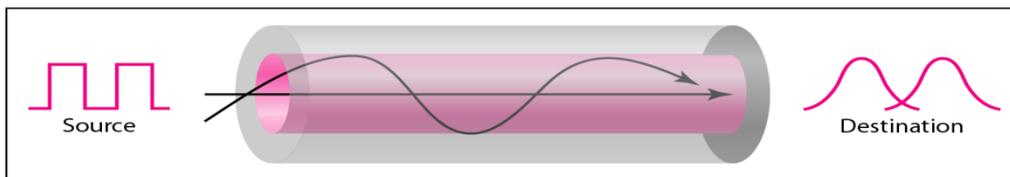
b. Multimode, graded index
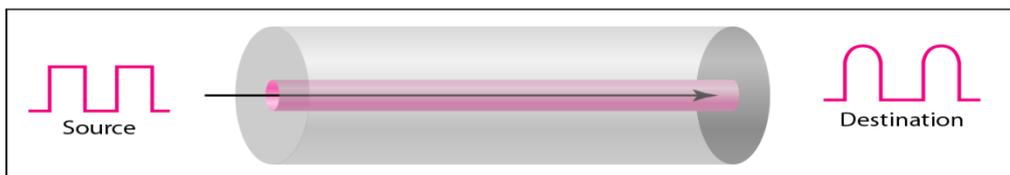
c. Single mode

Single mode:

- The single mode fiber is manufactured with a much smaller diameter than that of multimode fiber and with substantially lower density.
- The decrease in density results in a critical angle that is close enough to 90^0 to make the propagation of beams almost horizontal.
- In this case propagation is almost identical and delays are negligible.
- All the beams arrive at the destination together and can be recombined with little distortion to the signal.

d) State the situations under which gateways are necessary in the network.
(Necessary2Marks. example2Marks)

Gateway operates at all 7 layers of the OSI model. It is a device, which connects two different dissimilar n/w which have same function of communication. Situation where gateways are necessary for different n/w like Ethernet, Token Ring, and FDDI etc. It can communicate if they are using same protocol for communication like TCP/IP 08 Apple talk if they are using different protocol from a gateway cash forward packet across different n/w s that may also use different protocol.

Eg: if n/w A is a Token Ring network using TCP/IP & network B is a Novell Network, a gateway can relay frames between two.

This means that a gateway has not only had, but also between different protocols. In certain situations the only changes required are to the frame header. In other cases, the gateway must take case of different frame sizes, data rates, format, acknowledgement schemes, and priority schemes tec.

e) Explain connectionless and connection oriented protocol. Give the example for each type.
(Explanation 1 mark each, any one example 1 mark for each type)

Connection less protocol:
These protocols do not establish a connection between devices. It is manually achieved by transmitting information in one direction, from source to destination without checking to see if the destination is still there or if it is prepared to receive the information.

Connection-oriented protocol:
It means that when devices communication they perform hand sharing to set up on end to end connection. Usually one device begins by sending a request to open a connection, and the other responds.

Connectionless protocols:
1) IP
2) ICMP
3) UDP
1. IP
- IP is internet Protocol.
- It is unreliable protocol because it does not provide any error control and flow control.
- Packets in IP are called "Datagram"

2. ICMP
- It is internet control message protocol.
- It reports error and sends control messages.
- Error reporting messages include – destination unreachable, source quench , time exceed, parameter problem , redirection etc.
- Query message includes –echo request and reply, time stamp request and reply, router solicitation and advertisement. etc

3.UDP
- UDP is user datagram protocol.
- It is connectionless protocol because data is sent without establishing a connection between sender and receiver before sending the data.
- UDP is unreliable because data is delivered without acknowledgement.
- UDP does not perform Auto retransmission.
- UDP does not use flow control.

- UDP has high transmission speed.

Connection oriented protocol: 1) TCP   2) SLIP   3) PPP   4) SMTP

1) TCP
- TCP is transmission control protocol.
- It is connection oriented protocol because connection must be establish prior to transmission of data.
- TCP is reliable protocol because data is delivered with acknowledgement.
- TCP perform Auto Retransmission if the data is lost.
- TCP use flow control.
- TCP has low speed of transmission.

2. SLIP
- SLIP is serial line internet protocol
- SLIP does not perform error detection and correction.
- SLIP does not provide any authentication.
- SLIP is not approved internet standard.
- SLIP supports only Internet protocol (IP)
- SLIP supports static IP address assignment
3. PPP
- PPP is point to point protocol.
- PPP perform error detection
- PPP provides authentication and security.
- PPP is approved internet standard.
- PPP supports IP and other protocols.
- PPP supports Dynamic IP address assignment

4. **SMTP**
- SMTP is simple mail transfer protocol.
- It is connection oriented text based protocol in which sender communicates with receiver using a command and supplying data over reliable TCP connection.
- SMTP is standard application layer protocol for delivery of email over TCP/IP network. SMTP establish a TCP connection between Sender And port number 25 of receiver

f) **Explain following:**
  I.   **Telnet**
 II.   **FTP**
   (2 Marks for each)
1. **Telnet:**
- TELNET is abbreviation for Terminal Network. It is standard TCP/IP protocol for virtual terminal services proposed by ISO.
- TELNET enables establishment of connection to a remote system in such a way that a local terminal appears to be terminal at remote system.
- TELNET is general purpose client server application program.

2. **FTP.**
- FTP is a stranded mechanism provided by the Internet for copying a file from one host to the other.

- Some of the problem in transferring files from one system to the other are as follows:
- ➢ Two systems may use different file name conventions.
- ➢ Two systems may represent text data in different types.
- ➢ The directory structure of the two systems may be different.
- FTP provides a simple solution to all these problems.
- FTP established two connections between the client and server. One is for data transfer and the other is for the control information.
- The fact that FTP separates control and data makes it very efficient.
- The control connection uses simple rules of communication. Only one line of command or a line of response is transferred at a time.
- But the data connection uses more complex rules due to the variety of data types being transferred.
- FTP uses port 21 for the control connection and port 20 for the data connection.

Q.6. Attempt any FOUR :   16
 a) **Explain the function of each layer of OSI reference model with neat diagram.**
    (2 marks for diagram, 6 marks for functions of layers)

- OSI model (open system interconnection) model was developed by ISO (international standard organization)
- **<u>Function of OSI model</u>:**
    i. It provides way to understand how internetwork operates.
    ii. It gives guideline for creating network standard.
- 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:
1) Framing
2) Physical addressing
3) Flow control
4) Error control
5) Media access control
6) 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 e 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:
   1) logical addressing
   2) Routing.
   3) Congestion control
    4) Accounting and billing
   5) Address transformation
   6) 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:
   1) Service point addressing
   2) Segmentation and reassembly
   3) Connection control
    4) Flow control: Flow control is performed end to end 5) Error control

5. **Session layer:** Establishes, maintains, and synchronizes the interaction among communication systems It is responsible for dialog control and synchronization.
   Functionsof Session layer:
    1) Dialog control
   2) Synchronization, session and sub session
   3) 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

b) **Give the name of protocols used by different layers of TCP/IP. Discuss the function of ARP and RARP.**
(4 marks for protocols, 2 marks of ARP, 2 marks of RARP)

TCP/IP Model contains following layer.
1) Host-to-Network Layer -
- It defines characteristics of transmission media.
- It also concern with delivery of data when two systems are attached to same network
- SLIP
- PPP

2) Internet Layer –
- This layer permits host to inject packets into network and packet travels independently to destination.
- This layer defines packet format and protocol called IP (internet Protocol)
- ARP
- RARP
- IP

3) Transport Layer -
- It has TCP and UDP.
- TCP (transmission control protocol) –it is Reliable & connection oriented protocol.
- UDP (User Datagram Protocol)- it is Unreliable & connectionless protocol.

4) Application Layer -
- It includes virtual Terminal (TELNET), file transfer Protocol (FTP), simple Mail Transfer Protocol (SMTP) and other protocols like HTTP, WWW, DNS.

ARP:(Address resolution protocol)
- Networking H/W demands that a datagram contain the physical address of the intended recipient.
- If problem Address Resolution protocol (ARP) was developed.
- ARP takes the IP address of a host as input & gives its corresponding physical address as the output.
- As if doesn't know who must be having address if sends the broadcast message to all the computer on the network.
- The computer whose IP address matches the broadcast IP address sends a reply and along with if, its physical address to the broadcasting computer.
- All other computers lignose the broadcast message as IP address is different Now, when it is responding whose IP address gets match is aware of the sender.
- So it doesn't require sending broadcast message.
  As it knows sender hardware as well as IP address that the reason it uncast the reply so that senders only receive it.

RARP: (Reverse Address Resolution protocol)
- ARP is used for solving the problem of finding out which Ethernet address corresponding to a given IP address.

- But sometimes we have to solve a reverse problem. That means we have to obtain the IP address corresponding to the given Ethernet address.
- Such a problem can occur when booting a diskless workstation.
- The problem of obtaining the IP address when an Ethernet address is given, can be solved by using RARP(Reverse Address Resolution protocol)
- The newly booted workstation is allowed to broadcast its Ethernet address. The RARP server looks at this request. Then it looks up the Ethernet address in its configuration files and sends back the corresponding IP address.
- Using RARP is actually better than embedding an IP address in the memory image because it allows the same image to be used on all machines.
- If the IP address were buried inside the image, each workstation would need its own image.
- The disadvantage of RARP is that it uses a destination address of all ls(limited broadcasting) to reach the RARP server.
- But such broadcasts are not forwarded by routers, so a RARP server is needed on each network.

c) Explain Satellite communication with neat diagram
   (Diagram 2 marks, explanation 4 marks, frequency band 1 mark, application 1 mark)
   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 (6 Ghz). 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


Satellite Communication
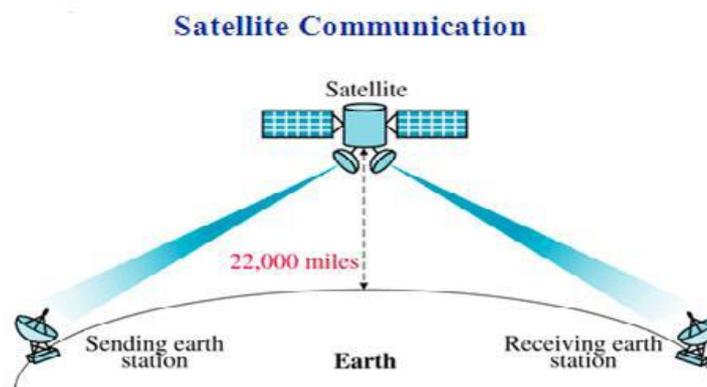
- As the entire signal transferring is happening in space. Thus this type of communication is known as space communication. The satellite does the functions of an antenna and the repeater together. If the earth along with its ground stations is revolving and the satellite is stationery, the sending and 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.

- However   3   satellites   are   needed   to   cover   earth's   surface   entirely.
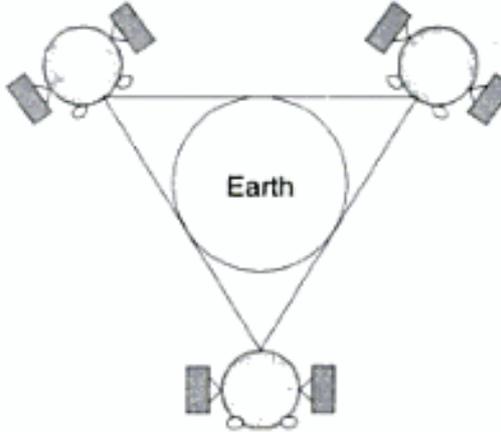
Frequency band used in satellite communication:

Band	Downlink	Uplink
C	3.7 to 4.2 Ghz	5.925 to 6.425Ghz
Ku	11.7 to 12.2 Ghz	14 to 14.5 Ghz
Ka	17.7 to 21 Ghz	27.5 to 31 Ghz

Application of satellite:
- Satellite television
- digital cinema
- satellite radio
- satellite internet access