



Summer – 15 EXAMINATION  
Model Answer

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**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) Compare human network and computer network.**

**(Each point- 1 Mark, any two points)**

<b>Human Network</b>	<b>Computer Network</b>
1. Human Network is a network of human beings.	1. Computer network is a interconnections of two or more computers
2. It consist of individuals ,organizations, schools, hospitals, work places etc	2. It consist of computers & connecting devices like as Hub or printer etc
3. Example: 1. Family network, Peer Network, Restaurant Network, Contact Network	3. Example : Internet

**b) Define 'packet' in concern with computer communication.**

**(Definition – 2 Marks)**

Packet: A packet is the unit of data that is routed between an origin and a destination on the Internet or any other packet-switched network.

**c) Define the term 'Topology'. List the names of any two network topologies.**

**(Definition- 1 Mark, Listing – 1 Mark)**

Topology: A topology is a usually "Schematic description of the arrangement of a network including its nodes and connecting lines (links).

OR

The way in which computers are connected *in a network* is called as topology.

OR

It is physical interconnection between various elements on computer network such as links & nodes.



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Types:

1. Bus
2. Ring
3. Star
4. Mesh
5. Tree
6. Hybrid

**d) State whether the bus is active or passive network. Justify your answer.  
( 2 Marks)**

Bus is a passive network.

The bus topology is usually used when a network installation is small, simple or temporary . In bus network, the cable is just one or more wires , with no active electronics to amplify the signal or pass it along from computer to computer . This makes the bus a passive network.

**or**

In the bus topology the major component is the backbone cable. The communication takes place through it and this backbone does not do any amplification or correction of signals passed through that's why bus can be called as passive network.

**e) Give any two applications of microwave communication.  
(Each application- 1Mark, Any Two applications)**

Two applications of Microwave Communication.

- 1) Radar uses microwave radiation to detect range, speed & other characteristics of remote object.
- 2) It is used in satellite for long distance communication.
- 3) Satellite phones.

**Any other relevant application such as cellular networks can also be considered.**

**f) State two applications of optical fiber cable.  
(Each application- 1Mark, Any Two applications)**

Two applications of optical fiber cable:

Applications are as follows

- 1) Military applications
- 2) Space applications
- 3) Cable television
- 4) Telephone
- 5) Computer networking
- 6) Medical applications

**g) What is CDMA? (2 Marks)**

**CDMA:** CDMA is code division multiple access. In CDMA more than one user is allowed to share a channel or sub channel with the help of direct – sequence spread spectrum signal. In CDMA each user is given a unique code sequence or signature sequence. This sequence allows the user to spread the information signal across the assigned frequency band.



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**h) What is PPP? Describe in brief.**

**(Meaning- 1Mark, Description- 1 Mark)**

PPP: PPP is Point-to-Point Protocol.

It is a data link protocol commonly used in establishing a direct communication between two networking nodes. It can also provide authentication, transmission encryption & compression.

**B. Attempt any Two:**

**8**

**a) Give advantages and disadvantages of computer network.**

**(Any 2 advantages- 2 Marks, Any 2 disadvantages- 2 Marks)**

**Advantages:**

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.
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.

**Disadvantages:**

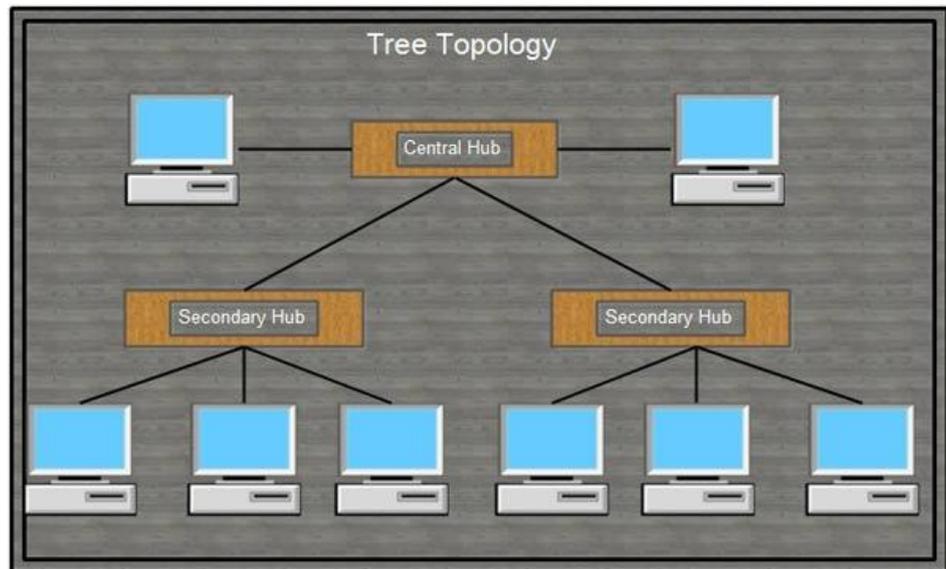
1. Security concerns: One of the major drawback of computer network is the security issues that are involved.
2. Virus and malware: Viruses can spread on a network easily because of the inter-connectivity of workstations.
3. Lack of robustness: If the main file server of a computer network breaks down, the entire system becomes useless.
4. Needs an efficient handler: The technical skills and knowledge required to operate and administer a computer network.

**b) Describe Tree Topology with neat diagram. State its advantages. (any two)**

**(Diagram- 1.5 Marks, Explanation -1.5 Marks, two advantages- 1 Mark)**

Tree Topology: A tree topology is variation of star. As in a star, nodes in a tree are linked to a central hub head end that controls the traffic to a network.

However, not every computer plugs into the central hub, majority of them are connected to a secondary hub which in turn is connected to the central hub as shown in fig.



The central hub in the tree is active hub which contains repeater. The repeater amplifies the signal & increase the distance a signal can travel. The secondary hubs may be active or passive. A passive hub provides a simple physical connection between the attached devices.  
Advantages:

1. Supported by several hardware and software vendors.
2. It allows more devices to be attached to a single central hub and can therefore increase the distance a signal can travel between devices.
3. It allows the network to isolate and prioritize communication from different computers i.e. the computers attached to one secondary hub can be given priority over the computers attached to another secondary hub.

- c) You are asked to establish a small network with minimum cost at least eight computers. Also it is necessary to use centralized database. Which type of network topology you will use? Justify your answer.

(Type of network- 1 Marks, Type of topology -1 Mark, Justification -2 Marks)

Due to necessity of centralized data base, we have to use the **Client-Server network**.

As the network is small & low cost, we can use **the bus topology**.

**The bus topology** has the following advantages:

1. Low cost
2. Easy control.
3. It is easy to set-up and extend bus network.
4. Cable length required for this topology is the least compared to other networks.
5. Linear Bus network is mostly used in small networks. Good for LAN.

**Q.2. Attempt any FOUR:**

- a) Describe classification of computer networks.

(Classification – 2 Marks, Explanation of any one network -2 Marks)

Networks are classified depending on the geography & their components.

**Classification of network by their geography:** 1. PAN 2. CAN 3. LAN 4. MAN 5. WAN

**Classification of network by their components by their component role:** 1. Peer-to- Peer Network 2. Client-server network



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**PAN:** A PAN is personal area network is used for communication among computer devices close to one's person. Wireless networking or Bluetooth technologies are the some examples of PAN. The communication network established for the purpose of connecting computer devices of personal use is known as the PAN.

**CAN:** CAN is a Campus Area Network is used to connect buildings across campuses of colleges or Universities. A CAN is actually a type of LAN. It is larger than a LAN but smaller than MAN. CAN is a network that connects two or more LANs but that is limited to a specific and contiguous geographical area such as a college campus, industrial complex or military base.

**Advantages:** 1. CAN is economical.

2. CAN is simple and easy to implement.

3. Helpful for universities & corporate organization to work from any block and receive the same speed of data together.

**LAN:** LAN is local area network. LAN is privately-owned networks covering a small geographic area(less than 1 km), like a home, office, building or group of buildings. LAN transmits data with a speed of several megabits per second.

**Advantages:**

1. The reliability of network is high because the failure of the computer in the network does not affect the functioning for other computers.
2. Addition of new computer to network is easy.
3. High rate of data transmission is possible.
4. Loss expensive to install.

**MAN:** A Metropolitan Area Network (MAN) is a large computer network that spans a metropolitan area or campus. A MAN typically covers an area up to 10 kms (city). The best example of MAN is the cable Television network, available in many cities. For an organization, the common use of a MAN is to extend their LAN connectivity between buildings/offices that are within the same city or urban area (hence the name Metropolitan Area Network). The organization can pass their Ethernet frames to the service provider MAN; the service provider will carry their frames across the MAN; and then deliver the frames to the destination site. From the customer's point of view, the MAN looks like one big (long) Ethernet link between their offices. The different sites could belong to the same IP subnet, and from the customer's viewpoint, no routing is required between their sites.

**Advantages:** 1. MAN spans large geographical area than LAN.

2. MAN falls in between the LAN and WAN therefore, increases the efficiency at handling data.

**WAN:** WAN is wide area network. WAN is a long-distance communication network that covers a wide geographic area, such as state or country. The most common example is internet. A WAN provides long-distance transmission of data, voice, image and video information over larger geographical areas that may comprise a country or even whole world.

**Advantages:** 1. WAN can connect the computer to a wider area geographically.

2. WAN shares software & resources with connecting workstations.

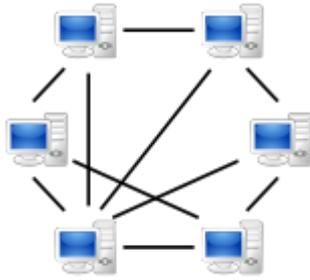
**Classification of network by their component role:**

**Peer-to-Peer Network:** Peer networks are defined by lack of central control over network. There are no fixed division into client & server. In this individual who forms a loose group can communicate with other in the group as shown in fig.

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Each computer is responsible for accessing & maintaining its own security & resources. In Peer-to- Peer network every computer can function both as client & server. In this type of network user simply share disk space & resources.

**Advantages:** 1. No extra investment in server hardware & software is required.  
2. Easy setup.  
3. No network administrator required.

**Disadvantages:** 1. Additional load due to sharing of resources.  
2. Lack of central organization, which can make data hard to find.  
3. Weak security.

**Client -Server network (Server-based network)**

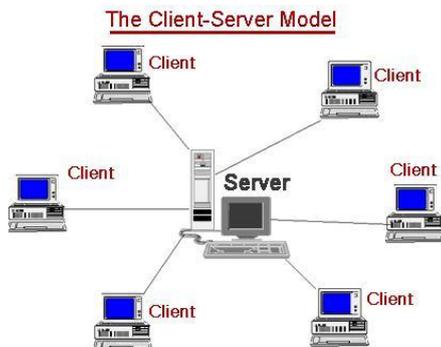


Fig. shows server- based network.

Server based networks are defined by presence of servers on a network that provides security & administration of network. Server-based network divide processing takes between client & servers. Client request service such as file printing & servers deliver them. Servers are more powerful than client computers.

**Advantages:**

1. Strong central security
2. Ability to share expensive equipments such as printer.
3. Ability of server to pull available hardware & software.
4. Easy manageability of large user.

**Disadvantages:**

1. Expensive dedicated hardware.
2. Expensive network operating system software & client license.
3. A dedicated network administrator.

**[Any suitable advantages & disadvantages shall be considered]**



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b) Enlist essential components required to design computer network. Describe any one in brief.

(1 mark for list, 1 mark for diagram, 2 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
- Computers
- Gateways

**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.

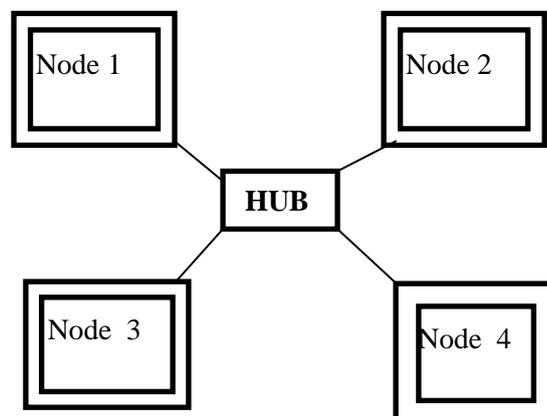
These central locations are called hubs. A hub organizes the cables and relays signals to the other media segments. There are three main types of hubs:

- 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. A passive 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.



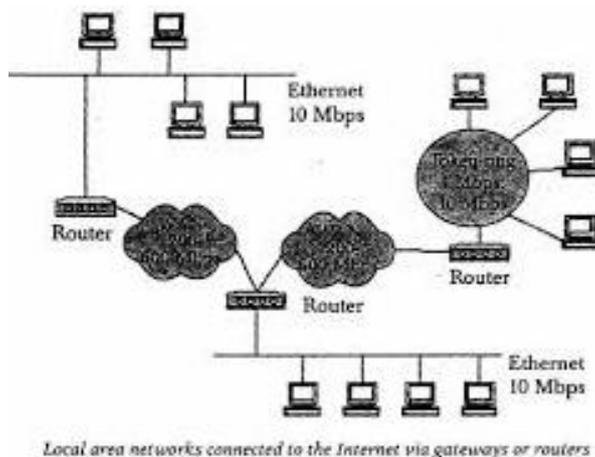
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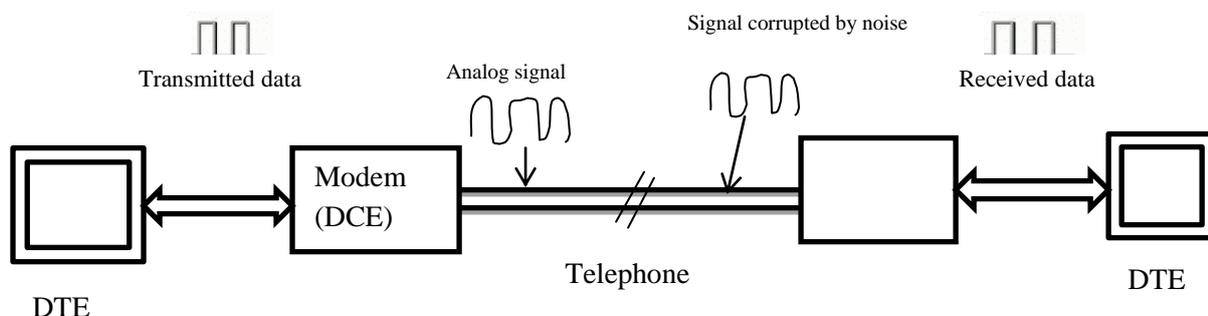
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- 2) **ROUTER:** Router is a device that connects 2 or more networks. It consist of hardware and software .hardware includes the physical interfaces to the various networks in the internetwork. Software in a router is OS and routing protocols management 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.



- 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.



- 4) **Switch:** A switch is a small hardware device that joins multiple computers together within one Local Area Network (LAN). Network switches operate at Data Link Layer of the OSI model. A switch is device that provides a central connection point for cables from workstations, servers and peripherals.

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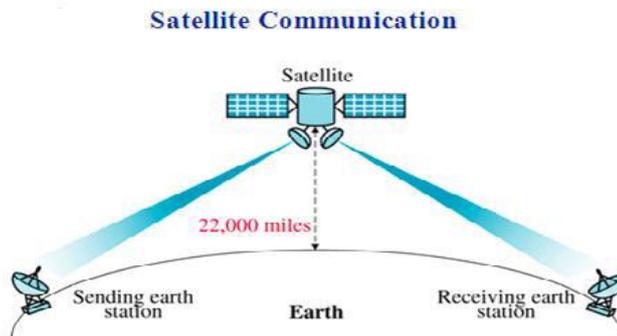
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- 5) Bridge: It is a device which connects two or more segment of a network. Use in DLL. If only forwards the packet which are for other.
- 6) Gateway: It is a device which connects two different dissimilar networks which has similar function of communication. It is also called as protocol convertor. It works in all layers of OSI model.
- c) **With the help of neat diagram explain satellite communication.**

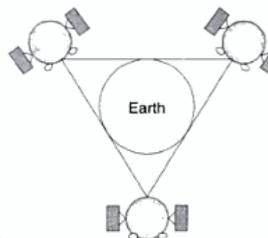
**(Diagram- 2 Marks, Explanation -2 Marks)**

**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



- 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.



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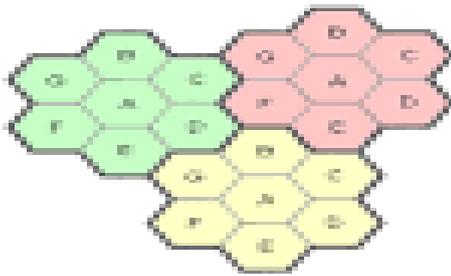
- Frequency band used in satellite communication:

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

- d) **What is the frequency band used for cellular telephony? How a mobile call is transmitted and received?**

**(Explanation of cellular telephony – 2 Marks, Explanation of mobile call transmission & reception – 2 Marks)**

What is the frequency band used for cellular telephony? How a mobile call is transmitted and received.



Analog transmission is used for cellular telephony. Frequency modulation is used for communication between the mobile phone and cell office. Two frequency bands are allocated for this purpose. One band of them is for the communication that is initiated by mobile phone & the other band for the land phone. Each channel requires a full-duplex dialog. For preventing interference, adjacent channels are rarely allocated; some of them are also required for control purposes.

This reduces the number of channels available for each cell. The same frequency band can be used for multiple non-adjacent cells as shown in fig.

**Calls using Mobile phones:**

Call is made from the mobile phone by entering 7-, 8-, or 10-digit phone number; the mobile phone itself scans the band & seeks a channel for setting up the call. After seeking, it sends this number to the closest cell office, which in turn, sends it to the CTO. If the called party is available, CTO lets MTSO (mobile telephone switching office) know. At this point, MTSO allocates an empty voice channel to the cell to establish the connection. The mobile phone adjust its tuning to the new channel & the dialog begins. When a land phone places a call to a mobile phone, the telephone central office sends the number to the MTSO. The MTSO performs a lookup to see where the mobile phone is currently placed by sending appropriate query signal to all the cells. This process is known paging. The cell where the mobile phone is currently located responds to the MTSO. Incoming calls work differently. To start with idle phone is continuously listen to paging channel to detect messages at directed at them. The MTSO then transmit the incoming call signal to that mobile phone & when the mobile phone is answered, the MTSO assigns a voice channel to the call, thus enabling the conversation.

- e) **State any four advantages of server based network over peer to peer network.**

**(Each advantage -1 Mark, any four advantages)**

1. Server based network has Strong central security over peer to peer network.
2. Sever based network has better performance for large number of users than Peer- to –Peer network.

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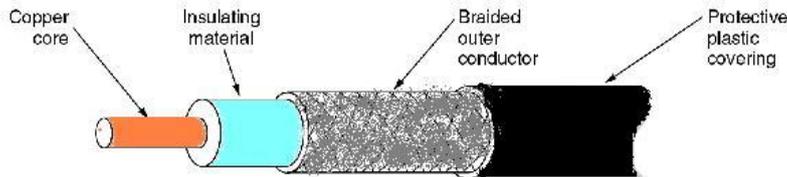
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3. Centralized backup can be taken in server based network.
4. Easy manageability for large number of users.
5. Very reliable dedicated Network operating system (NOS) required.
6. In server based network server is more powerful than client.

f) **Draw the constructional sketch of co-axial cable. Describe any three characteristics of co-axial cable.**

( Sketch -2 Marks, Any three characteristics- 2 Marks)

Co-axial cable:



Characteristics of coaxial cable are:-

1. Used to transmit both analog & digital signals.
2. It carries signals of higher frequency ranges than twisted pair cable.
3. Lower attenuation than twisted pair cable.
4. Supports higher bandwidth.
5. Requires amplifiers every few kilometers for long distance transmission.
6. Requires repeaters every few kilometers for digital transmission.

**Q.3. Attempt any FOUR:**

**16**

a) **List four types of servers. Describe them in brief.**  
(Listing of servers 1 mark, description 3 marks)

**Types:**

1. Application Server
2. Message Server
3. Database Server
4. Web server

**DESCRIPTION:**

**Application Servers:** The application server often serves to connect database servers with the end-user, thus acting as a kind of "middleware" that releases stored information requested by said user. The server is usually responsible for properly decoding and recoding data and providing security over connections.

**Message Servers:** These servers provide instant, real-time communication between users, regardless of where a user may be. Message servers allow a wide variety of communication methods, from simple forms such as text to more complex forms such as video, audio and graphics.

**Database Servers:** These servers manage the database that is stored in that server using the SQL database management system. A client request is sent in the form of an SQL query to the server. That server in turn searches through the database for the requested information and sends the results to the client.

**Web Servers:** Web servers provide access to the Internet through the Hyper Text Transfer Protocol (HTTP). Files in a web server use Hyper Text Markup Language (HTML) to display content on web browsers. A web server usually receives requests from a web browser and sends back the requested HTML file and related graphic files.



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b) **State any two advantages of ring topology, define token. State whether ring topology is broadcast or point to point network.**

(Advantages 2 marks, definition of token 1 mark; ring topology is broadcast or point to point 1 mark)

**Advantages of Ring Topology:**

- 1) Here, since the system provides point to point flow of data i.e. the data is moving in one direction from one computer to another i.e. active topology, hence no collision occurs in the system.
- 2) Cable faults are easily identified.
- 3) Dual loop rings can be easily effective.
- 4) Packet or data delivery is guaranteed.
- 5) Every computer is having equal priority.

**What is Token?**

Token is a special three byte frame that travels around the ring network.

It can flow clockwise or anticlockwise.

Ring topology is a point to point network.

c) **In brief describe OSI model with suitable diagram.**

(Layered structure 1 mark and explanation 3 marks)

OSI model (open system interconnection) model was developed by ISO(international standard organization)

Function of OSI model

- 1) It provides way to understand how internet work operates.
- 2) 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.
- 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 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, synchronizes the interaction among communication systems  
It is responsible for dialog control and synchronization

Functions of 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: Translation, encryption, compression

**7) Application layer:** It enables user to access the network. It provides user interfaces and support for services like email, remote file access.

Functions: network virtual terminal, file transfer access and management, mail services and directory services

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d) Describe connection oriented and connectionless services.

(Connection oriented services 2 marks and connectionless services 2 marks)

**Connection-oriented** communication includes the steps of setting up a call from one computer to another, transmitting/receiving data, and then releasing the call, just like a voice phone call. However, the network connecting the computers is a packet switched network, unlike the phone system's circuit switched network. Connection-oriented communication is done in one of two ways over a packet switched network: with and without virtual circuits.

Connection oriented service is more reliable than connectionless service. We can send the message in connection oriented service if there is an error at the receivers end. Example of connection oriented is **TCP (Transmission Control Protocol)** protocol.

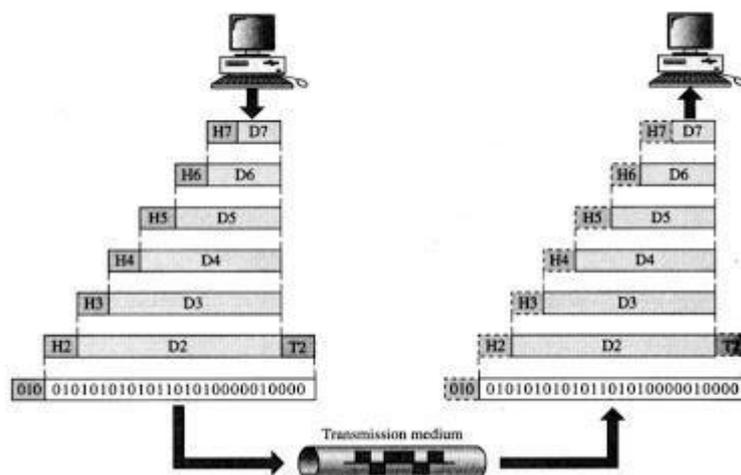
**Connectionless** communication is just packet switching where no call establishment and release occur. A message is broken into packets, and each packet is transferred separately. Moreover, the packets can travel different route to the destination since there is no connection. Connectionless service is typically provided by the **UDP (User Datagram Protocol)**. The packets transferred using UDP are also called **datagrams**.

**Difference between connection oriented and connectionless services:**

1. In connection oriented service **authentication** is needed while connectionless service does not need any authentication.
2. Connection oriented protocol makes a connection and checks (confirms delivery of message) whether message is received or not and sends again if an error occurs connectionless service protocol does not guarantees a delivery.
3. Connection oriented service is more **reliable** than connectionless service.
4. Connection oriented service interface is **stream based** and connectionless is **message based**.

e) Explain data encapsulation in OSI

(Diagram of data encapsulation 2 marks , explanation 2 marks)



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 headers and footers to the data is called as data encapsulation. The headers and footers



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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.

f) **Compare UDP and TCP (four points)**  
(Any 4 points, 1 mark each )

TCP	UDP
1. TCP is connection oriented protocol	1. UDP is connection less protocol
2. It provides reliable delivery of messages	2. It provides unreliable delivery of messages
3. It assigns datagram size dynamically for efficiency.	3. Every datagram segment is of the same size.
4. TCP has flow control	4. UDP has no flow control
5. Overhead is low	5. Overhead is very low.
6. Transmission speed is high	6. Transmission speed is very high

**Q.4. Attempt any FOUR:**

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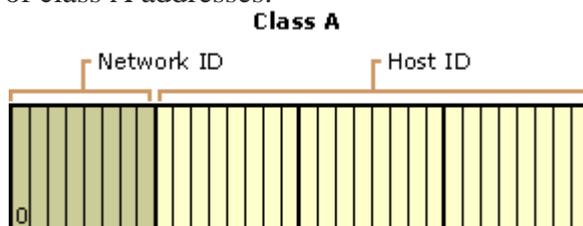
a) **Describe different IP address classes**  
(Any 4 classes with explanation 1 mark each)

The Internet community originally defined five *address classes* to accommodate networks of varying sizes. Microsoft TCP/IP supports class A, B, and C addresses assigned to hosts. The class of address defines which bits are used for the network ID and which bits are used for the host ID. It also defines the possible number of networks and the number of hosts per network.

Class	Range for first byte
A	0-127
B	128-191
C	192-223
D	224-239
E	240-255

1) Class A

*Class A* addresses are assigned to networks with a very large number of hosts. The high-order bit in a class A address is always set to zero. The next seven bits complete the network ID. The remaining 24 bits (the last three octets) represent the host ID. This allows for 126 networks and 16,777,214 hosts per network. Figure illustrates the structure of class A addresses.



2) Class B

*Class B* addresses are assigned to medium-sized to large-sized networks. The two high-order bits in a class B address are always set to binary 1 0. The next 14 bits complete the

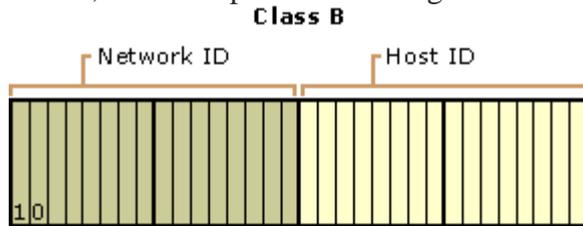


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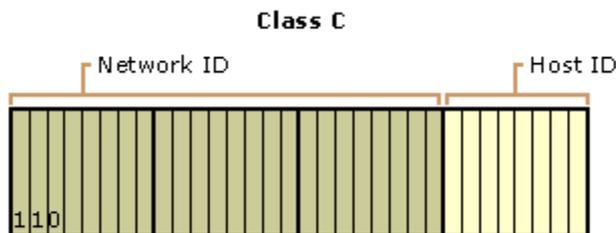
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network ID. The remaining 16 bits represent the host ID. This allows for 16,384 networks and 65,534 hosts per network. Figure illustrates the structure of class B addresses.



3) Class C

*Class C* addresses are used for small networks. The three high-order bits in a class C address are always set to binary 1 1 0. The next 21 bits complete the network ID. The remaining 8 bits (last octet) represent the host ID. This allows for 2,097,152 networks and 254 hosts per network. Figure illustrates the structure of class C addresses.



4) Class D

*Class D* addresses are reserved for IP multicast addresses. The four high-order bits in a class D address are always set to binary 1 1 1 0. The remaining bits are for the address that interested hosts recognize. Microsoft supports class D addresses for applications to multicast data to multicast-capable hosts on an internetwork.

5) Class E

*Class E* is an experimental address that is reserved for future use. The high-order bits in a class E address are set to 1111.

b) Compare IPv4 and IPv6.



(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
4. IP header includes a checksum.	4. IP header does not include a checksum.
5. IP header includes options.	5. All optional data is moved to IPv6
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
9. IP address represented in decimal number system	9. IP address is represented in hexadecimal number system
10. '.' used as separator	10. ':' used as separator
11. Uses host address (A) resource records in the domain name system to map host names to IPv4 addresses.	11. Uses host address (AAAA) resource records in the domain name system to map host names to IPv6 addresses

c) Explain in brief the functioning of Bluetooth.  
(Diagram 1 mark, explanation 3 marks)

### What is Bluetooth ?

1. A cable-replacement technology that can be used to connect almost any device to any other device
2. Radio interface enabling electronic devices to communicate wirelessly via short range (10 meters) **ad-hoc** radio connections
3. a standard for a small , cheap radio chip to be plugged into computers, printers, mobile phones, etc.
4. Uses the radio range of 2.45 GHz
5. Theoretical maximum bandwidth is 1 Mb/s
6. Several Bluetooth devices can form an ad hoc network called a “piconet”
7. In a piconet one device acts as a master (sets frequency hopping behavior) and the others as slaves

Example: A conference room with many laptops wishing to communicate with each other

### Bluetooth Architecture

#### 1) Piconet

Each piconet has one master and up to 7 simultaneous slaves

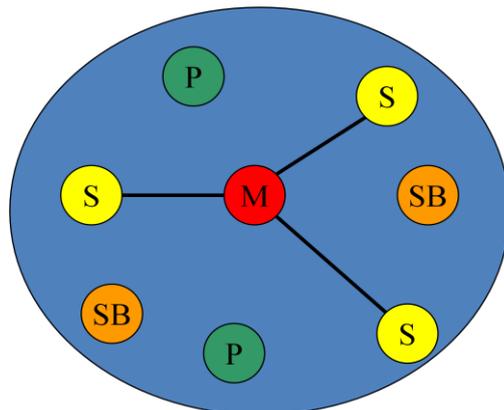
Master : device that initiates a data exchange.

Slave : device that responds to the master

All devices in a piconet hop together

Master gives slaves its clock and device ID

Non-piconet devices are in standby



M=Master P=Parked  
S=Slave SB=Standby

#### 2) Scatternet

- Linking of multiple piconets through the master or slave devices
- Bluetooth devices have point-to-multipoint capability to engage in Scatternet communication.
- Devices can be slave in one piconet and master of another

d) List any four IP functions.



**(Each function 1 mark)**

1. **Addressing:** In order to perform the job of delivering datagrams, IP must know where to deliver them to. For this reason, IP includes a mechanism for host addressing. Furthermore, since IP operates over internetworks, its system is designed to allow unique addressing of devices across arbitrarily large networks. It also contains a structure to facilitate the routing of datagrams to distant networks if that is required.
  2. **Data Encapsulation and Formatting/Packaging:** IP accepts data from the transport layer protocols UDP and TCP. It then encapsulates this data into an IP datagram using a special format prior to transmission.
  3. **Fragmentation and Reassembly:** IP datagrams are passed down to the data link layer for transmission on the local network. However, the maximum frame size of each physical/data-link network using IP may be different. For this reason, IP includes the ability to *fragment* IP datagrams into pieces so they can each be carried on the local network. The receiving device uses the reassembly function to recreate the whole IP datagram again.
  4. **Routing / Indirect Delivery:** When an IP datagram must be sent to a destination on the same local network, this can be done easily using the network's underlying LAN/WLAN/WAN protocol using what is sometimes called *direct delivery*. However, in many (if not most cases) the final destination is on a distant network not directly attached to the source. In this situation the datagram must be delivered *indirectly*. This is accomplished by routing the datagram through intermediate devices.
- e) **What is token passing? List any four protocols associated with application layer of OSI model.**  
**(Token passing definition 1 mark, any 4 protocols of application layer 1 mark each)**  
Token passing is a method of passing the token in the ring network either clockwise or anticlockwise.  
Protocols associated **with** application layer of OSI model are as follows:
1. TELNET
  2. File Transfer Protocol (FTP)
  3. Simple Mail Transfer Protocol (SMTP)
  4. Domain Name System (DNS)
  5. Hypertext Transfer Protocol (HTTP)
- f) **Compare LAN, MAN and WAN.**  
**(1 mark for each point, any four comparison points)**



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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 fiber cables, wireless	4 Transmission media – PSTN or Satellite links.
5. Data rate is high.	5. Data rate is moderate.	5. Data rate is low.

**Q.5. Attempt any FOUR:**

**16**

**a) Differentiate SLIP and PPP.(any four points)  
(Any 4 each 1Mark)**

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.

**b) Describe the function of repeater. In which situation the repeater is used in the network?**



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**(Any 2 functions – 1M; Situation: 2M)**

- 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.

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. A repeater can be used at as many points in the network as required.

**c) Describe the following terms with reference to cellular telephony**

**i. Hard Hand Off**

**ii. Soft Hand Off**  
**(Each term 2M)**

**i. Hard Hand Off**

In Hard Hand Off a mobile station only communicates with one base station. When the (*mobile handset*) MS moves from 1 cell to another, communication must first be broken with the previous base station before communication can be reestablished with the new one. This may create a rough transition. Hard hand off was used in earlier systems.

**ii. Soft Hand Off**

In this case, a mobile station can communicate with two base stations at the same time this means that, during Hand off a mobile station may continue with the new base station before breaking off from the old one. This is used in new systems.

*This provides seamless connectivity while roaming from one cell to another.*

**d) What is NIC? State functions of NIC.**

**(Definition- 1M; Any three functions – 1M each)**

NIC:

NIC is a Network Interface Card which is a small card inserted or plugged on the motherboard of the host. It has a small CPU, memory and a limited instruction set required for the network related functions. Each NIC has a unique hardware address or physical address to identify the host uniquely, which ensures that its unique all over world.

These functions include,

- It accepts instructions from host to transfer data to/ from cable.
- It checks the status of the bus with the help of the transceiver and waits till the bus is idle.
- It sends the data bit by bit once the bus is idle.
- It inserts the CRC in the header of the frame while transmitting.
- While accepting the data, NIC compares the destination address in the frame with its own hardware address; If matches then only it is accepted otherwise rejected.
- Validating the input frame by checking its CRC to ensure that the data is error free.



- e) **Site addresses 201.70.64.0. The company needs six subnets. Design subnets. Write addresses of all subnets.**

**(Identify the class and bits : 1M; Each subnet address : ½ M.)**

Site Address : 201.70.64.0

No. of Subnets : 6

Class : Class C

Default subnet mask : 255.255.255.0

To design 6 subnets :

No. of bits used in the host id:

$$2^n - 2 \geq 6 \quad ; \text{ where } n = \text{number of bits}$$

If  $n=3$ ;

$$2^3 - 2 \geq 6.$$

Therefore, **n= 3.**

Given IP : 201.70.64.0

Network ID : 201.70.64

**Subnet 1:**

The bit combination is **001.**

Taking last octet in binary : **0 0 1 0 0 0 0 0** =  $32_{(10)}$

Hence the subnet address is, 201.70.64. **32**

**Subnet 2:**

The bit combination is **01 0.**

Taking last octet in binary : **0 0 1 0 0 0 0 0** =  $64_{(10)}$

Hence the subnet address is, 201.70.64. **64**

**Subnet 3:**

The bit combination is **011.**

Taking last octet in binary : **0 1 1 0 0 0 0 0** =  $96_{(10)}$

Hence the subnet address is, 201.70.64. **96**

**Subnet 4:**

The bit combination is **100.**

Taking last octet in binary : **1 0 0 0 0 0 0 0** =  $128_{(10)}$

Hence the subnet address is, 201.70.64. **128**

**Subnet 5:**

The bit combination is **101.**

Taking last octet in binary : **1 0 1 0 0 0 0 0** =  $160_{(10)}$

Hence the subnet address is, 201.70.64. **160**

**Subnet 6:**

The bit combination is **110.**

Taking last octet in binary : **1 1 0 0 0 0 0 0** =  $192_{(10)}$

Hence the subnet address is, 201.70.64. **192**

f) In which situation MODEM are useful in network.  
(Any two situations: 2 M each)

1. Modems are used when digital signal is sent over analog medium.
2. When the data transmission is over an analog medium such as telephone lines, Modem is used for converting analog signal to digital signal.
3. When a home user need to connect to ISP a modem is used to connect to telephone lines.  
Or when user wants to connect internet by telephone line.

Q.6. Attempt any TWO:

16

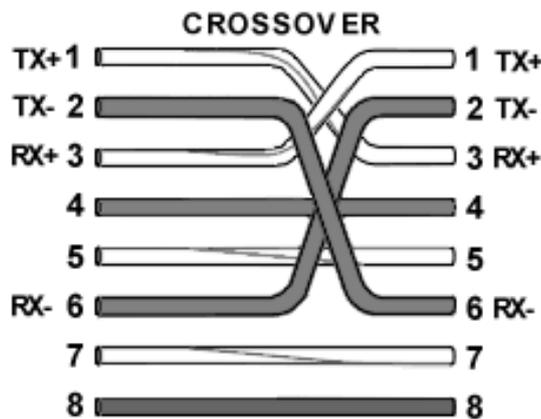
a) How cross cable is created? Draw figure and explain. Give its application.  
(Creation: 4M; Diagram : 2M; Application : 2M)

Crossover cable is created by connecting the two UTP cables by swapping transmission and reception signals as shown below:

Here, One end of the cable is crimped in the same way as straight cable, on the other end the following change has to be done,

1-White and 3 orange- white are to be connected

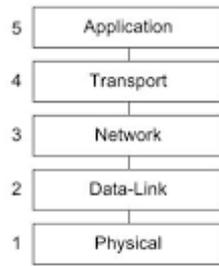
2 –Green and 6 orange are to be connected as shown in the fig below.



**Application:**

- While connecting one computer to another without going through router, switch or hub, the crossover cables are used.
- These are also used when connecting one computer to a device directly, without any other connecting device.
- Cross cable is used for connecting similar level devices.  
For example : two computers or connecting computer with hub since all are level 1 devices.

b) Describe TCP/IP model with suitable diagram. Describe the function of each layer.  
(Diagram 2M; Explanation 6M)



TCP/IP Model

### 1. Application Layer

The application layer is concerned with providing network services to applications. There are many application network processes and protocols that work at this layer, including HyperText Transfer Protocol (HTTP), Simple Mail Transport Protocol (SMTP) and File Transfer Protocol (FTP).

### 2. Transport Layer

This layer is concerned with the transmission of the data. The two main protocols that operate at this layer are Transmission Control Protocol (TCP) and User Datagram Protocol (UDP). TCP is regarded as being the reliable transmission protocol and it guarantees that the proper data transfer will take place. UDP is not as complex as TCP and as such is not designed to be reliable or guarantee data delivery.

### 3. Network Layer or Internet layer:

This layer is concerned with the format of datagrams as defined in the internet protocol(IP) and also about the mechanism of forwarding datagrams from the source computer to the final destination via one or more routers. The other protocol in this layer include Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP) and Internet Control Message Protocol (ICMP).

### 4. Data Link layer

This is similar to the other network models which deal with Media Access and Control (MAC) and also with the frame formats.

### 5. Physical Layer:

This deals with hardware level, connections as in other network model.

[Note: TCP/IP four or Five layer May be considered]

### c) With the help of neat sketch describe the working of router. Describe in detail the operation of router considering OSI model.

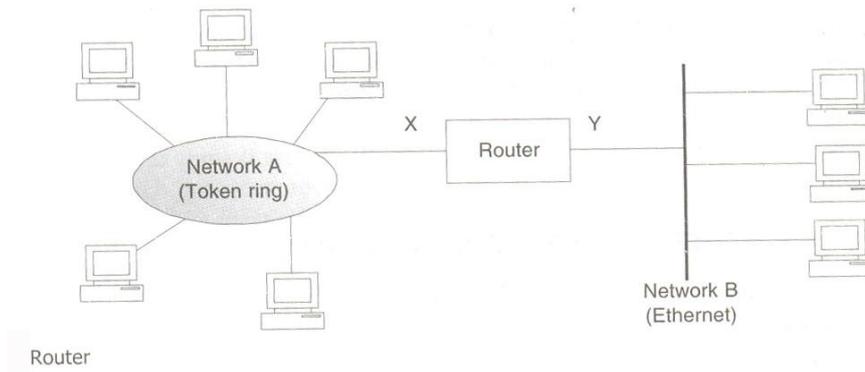
(Explanation of Router 4M, Description of Router in OSI 4M)

Router is a device that connects two or more computer network together this allows two or more disparate computer network to send data to each other.

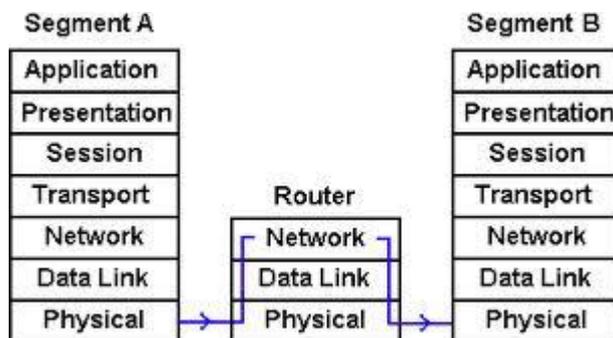
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The figure shows a router connecting to two networks viz: A (Token Ring) and B (Ethernet) at points X and Y respectively. This means that the router must have two interfaces and also two Network interface cards (NICs) one to interact with network A at point X, and the other to interact with network B at point Y. this enable it to send data between the two networks A and B. a router connect more than two networks.



A router operates at a the ~~physical, data link and~~ network layer of the OSI model, as shown in fig a router is termed as an intelligent device.

A router is useful for interconnecting two or more networks.

These networks can be heterogeneous, which means that they can differ in their physical characteristics such as frame size, transmission rates, topologies, addressing etc. thus, if a router has to connect such different networks, it has to consider all these issues.

A router has to determine the best possible transmission path among several available.