SECTION A: 30 Marks

ANSWER <u>ALL</u> QUESTIONS IN SECTION A AND ANY TWO QUESTIONS IN SECTION B

TIME ALLOWED: 3 HOURS

<u>SECTION A:</u>

QUESTION ONE

(a)   (i) Differentiate between a network and the Internet   (2 marks)

(ii) Discuss the services that network applications provide to users (8 marks)

(b) Explain the practical difference between the network layer protocol eg. IP and the transport layer protocol eg. TCP   (6 marks)

(c) Define the following terms as used in data communication:
      (i) Topology
      (ii) Node
      (ii) Segment
      (iii) Backbone

                                                      (2 marks)

(d) Describe the process of crimping both straight-through and cross-over UTP cables, indicating clearly the arrangement of the ISO color codes.   (6 marks)

(e) Besides signal flow, it is important to observe data traffic flow in communication Channels as this will help in avoiding collision of data signals in transit.
      (i)   State and explain the three data traffic flow modes   (3 marks)
      (ii)   Describe the elements of data communication   (3 marks)

SECTION B:

QUESTION TWO:

(b) Briefly discuss the major events that led to the development of networks, based on
   Hobbes' Internet Timeline v5.1 arguments.   (18 marks)
(b) Explain the key elements of a Protocol.   (2 marks)

QUESTION THREE:

(a) With the aid of diagrams, discuss any THREE types of network topologies giving
   TWO advantages and disadvantages of each topology   (18 marks)
(b) How does Ethernet work?   (2 marks)

QUESTION FOUR

   (a) What purpose does the OSI reference model play in communication networks?
                                                                                (2 marks)
   (b) Explain the seven layer OSI reference model and identify the devices used in each
      layer.   (18 marks)

QUESTION FIVE:

   (a) List any THREE guided and unguided mediums.   (3 marks)
   (b) Differentiate between Circuit switching and Packet Switching   (3 marks)
   (c) Explain clearly showing the differences between the following networking
      structures: LAN, WAN and MAN   (9 marks)
   (d) Explain the need of analogue to digital and digital to analog conversions in data
      communication.   (5 marks)

MARKING SCHEME

SECTION A:

QUESTION ONE

(a) (i) Differentiate between a network and the Internet   (2 marks)
- A network is a collection of hardware devices and software protocols that connect computing devices.
-The Internet is a worldwide meta network that interconnects millions of computing devices.

   (ii) Discuss the services that network applications provide to users (8 marks)

   Telecommunications services
   - **email, internet relay chat (IRC), discussion boards and remote access eg via mobiles, remote desktop and social networking.**
   File Services
   - **File transfer**
   - **File sharing**
   - **Database**
   - **Shared resources**
   - **Web**

(b) Explain the practical difference between the network layer protocol eg. IP and the transport layer protocol eg. TCP   (6 marks)

   - **A network-layer protocol (e.g., IP) routes packets from network to network**
   - **A transport-layer protocol (e.g., TCP) routes messages from program to program**

(c) Define the following terms as used in networking:
   (i) Topology
   (ii) Node
   (ii) Segment
   (iii) Backbone   (4 marks)

Node - Anything that is connected to the network. While a node is typically a
**   computer, it can also be something like a printer or CD-ROM tower.**
Segment - Any portion of a network that is separated, by a switch, bridge or router,
**   from other parts of the network.**
Backbone - The main cabling of a network that all of the segments connect to.
**   Typically, the backbone is capable of carrying more information than**
**   the individual segments. For example, each segment may have a transfer**
**   rate of 10 Mbps (megabits per second: 1 million bits a second), while the**

backbone may operate at 100 Mbps.
Topology - The way that each node is physically connected to the network.

(d) Describe the process of crimping both straight-through and cross-over UTP cable, indicating clearly the arrangement of the ISO color codes.   (6 marks)

SECTION B:

QUESTION TWO:

Briefly discuss the major events that led to the development of networks, based on Hobbes' Internet Timeline v5.1 arguments.   (18 marks)

QUESTION THREE:

With the aid of diagrams, discuss any THREE types of network topologies giving TWO advantages and disadvantages of each topology

                (18 marks)

Bus Topology
  • In a Bus topology, all devices attach to the same transmission medium. The medium has a physical beginning and end. All buses are implemented using electrical cable, usually coax, and the ends of the cable must be terminated with a terminating resistor that matches the impedance of the cable. The terminating resistor prevents data reflections from coming across as data corruption. The bus is considered a multipoint system because all devices tap into the same backbone cable.
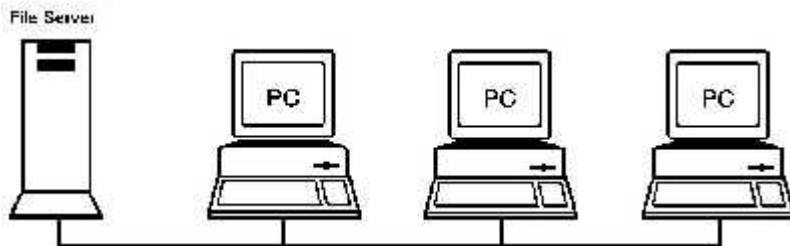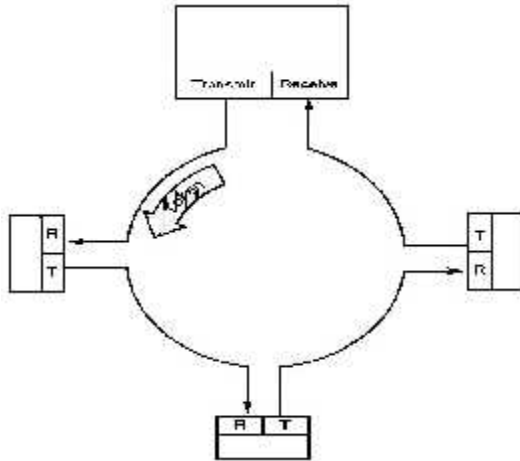

Advantages of Bus Topology
It is easy to handle and implement.
It is best suited for small networks.

Disadvantages of Bus Topology
The cable length is limited. This limits the number of stations that can be connected.
This network topology can perform well only for a limited number of nodes.

Ring Topology
- The Ring Topology is a physical, closed loop consisting of point-to-point links. In the diagram you can see how each node on the ring acts as a repeater. It receives a transmission from the previous node and amplifies it before passing it on.

Advantage of Ring Topology
The data being transmitted between two nodes passes through all the intermediate nodes. A central server is not required for the management of this topology.

Disadvantages of Ring Topology
The failure of a single node of the network can cause the entire network to fail.
The movement or changes made to network nodes affects the performance of the entire network.

Mesh Topology
Each node has a separate connection to every other node.

Advantage of Mesh Topology
The arrangement of the network nodes is such that it is possible to transmit data from one node to many other nodes at the same time.
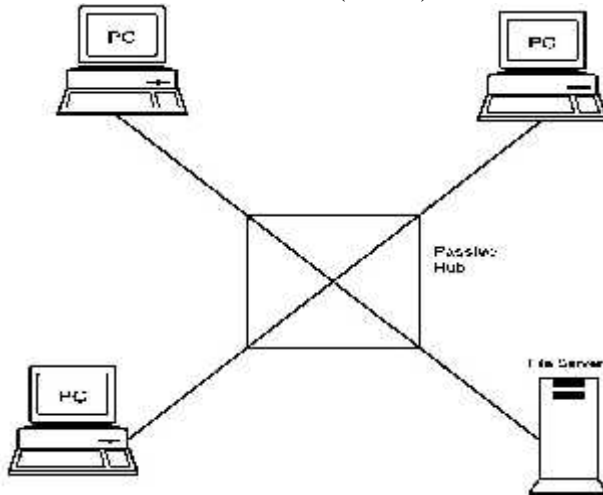
Disadvantage of Mesh Topology
The arrangement wherein every network node is connected to every other node of the network, many of the connections serve no major purpose. This leads to the redundancy of many of the network connections.

Star Topology
- The star topology is a popular method of connecting the cabling in a computer network. In a star, each device connects to a central point via a point-to-point link.

Depending on the locical architecture used, several names are used for the central point includeing the following:
- Hub
- Multipoint Repeater
- Concentrator
- Multi-Access Unit (MAU)

Advantages of Star Topology
Due to its centralized nature, the topology offers simplicity of operation.
It also achieves an isolation of each device in the network.

Disadvantage of Star Topology
The network operation depends on the functioning of the central hub. Hence, the failure of the central hub leads to the failure of the entire network.

QUESTION FOUR

(c) What purpose does the OSI reference model play in communication networks?

(d) Explain the seven layer OSI reference model and identify the devices used in each layer. (18 marks)

- **Application layer (gateway)**
- **Physical**
- **Session layer**
- **Transport (gateway)**
- **Network (router)**
- **Data Link Layer (bridge, switch)**
- **Presentation layer**

QUESTION FIVE:

(a) List any TRHEE guided and unguided mediums.   (3 marks)

Guided:
- **Coaxial cable**
- **Fiber optic cable**
- **twisted pair**

Unguided:
- **satellite**
- **laser**
- **wireless transmissions**

(b) Differentiate between Circuit switching and Packet Switching   (3 marks)

Circuit Switching:
- **Circuit switching is a dedicated communications path established between two stations or multiple end points through nodes of the WAN**
- **Transmission path is a connected sequence of physical link between nodes.**
- **On each link, a logical channel is dedicated to the connection. Data generated by the source station are transmitted along dedicated path as rapidly as possible.**
- **At each node, incoming data are routed or switched to the appropriate outgoing channel without excessive delay. However, if data processing is required, some delay is experienced.**
- **Example of circuit switching above is the telephone networks.**

Packet Switching:
- **It is not necessary (as in circuit switching) to dedicate transmission capacity along a path through the WAN rather data are sent out in a sequence of small chucks, called <u>packets</u>.**
- **Each packet, consisting of several bits is passed through the network from node to node along some path leading from the source to the destination**
- **At each node along the path, the entire packet is received, stored briefly, and then transmitted to the next node.**
- **At destination all individual packets are assembled together to form the complete text and message from the source. Each packet is identified as to its place in the overall text for reassembly.**
- **Packet switching networks are commonly used for terminal-to-computer and computer-to-computer communications.**
- **If packet errors occur, the packet is retransmitted.**

(c) Explain clearly showing the differences between the following networking structures: LAN, WAN and MAN   (6 marks)

LAN:

- **Small interconnected of personal computers or workstations and printers within a building or small area up to 10 Kms.**
- **Small group of workers that share common application programs and communication needs.**
- **LANs are capable of very high transmission rates (100s Mb/s to G b/s).**
- **LAN equipment usually owned by organization. Medium may be owned or leased from telephone company provider or common carrier.**

WAN:

- **WANs were developed to communicate over a large geographical area (e.g. lab-to-lab; city-to-city; east coast-to-west coast; North America-to-South America etc)**
- **WANs require the crossing of public right of ways (under control and regulations of the interstate commerce and institute of telephone and data communications established by the gov't and international treaties).**
- **WANs around the world rely on the infrastructure established by the telephone companies ("common carrier") or public switched telephone network (PSTN).**

MAN:

- **Metropolitan area network (MAN), which is used for medium size area. examples for a city or a state.**

(d) Besides signal flow, it is important to observe data traffic flow in communication
     Channels as this will help in avoiding collision of data signals in transit.
     (iii)   State and explain the three data traffic flow modes   (3 marks)
- **Simplex mode:- data can travel in only one direction at all times**
- **Half duplex mode:- can support two-way traffic but data can only travel in one direction at one time**
- **Full duplex transmission:- can send data in both directions simultaneously**

     (iv)   Describe the elements of data communication   (3 marks)