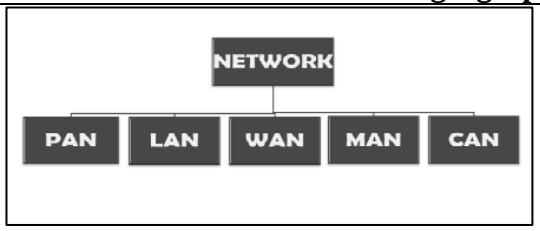
SUMMER – 19 EXAMINATIONS

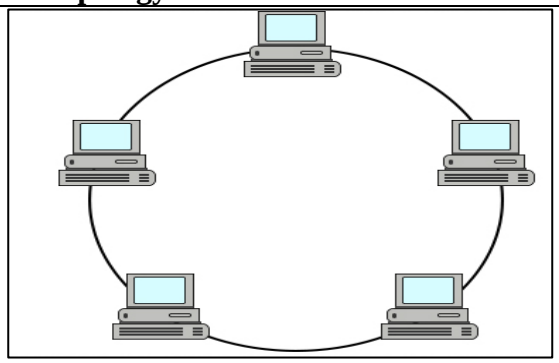
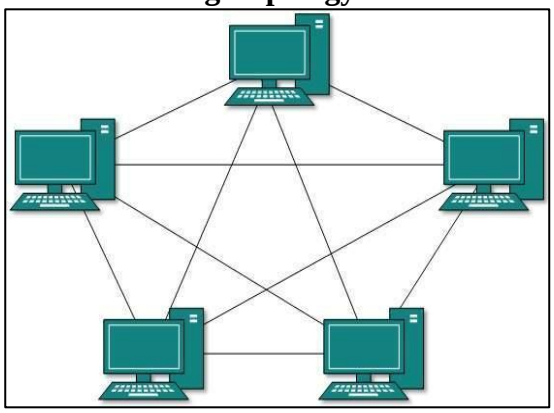
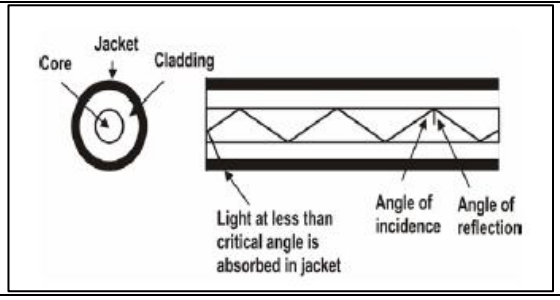
Subject Name: Computer Network **Model Answer** **Subject Code: 22417**

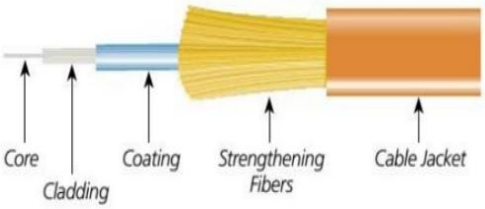
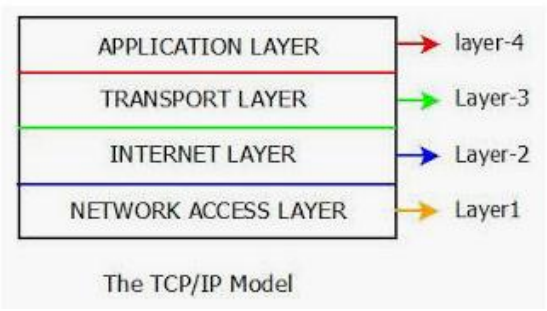
Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1		**Attempt any Five of the following:**	**10 M**
	a	**List network classification based on network geographic area.**	**2 M**
	Ans	 • Personal Area Network • Local Area Network • Wide Area Network • Metropolitan Area Network • Campus Area Network	Listing-2 M
	b	**State any two differences between switch and hub.**	**2 M**

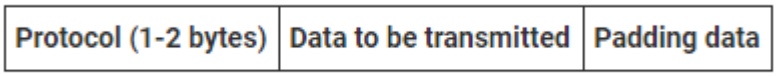
<table>
<tr><td></td><td>Ans</td><td>
<table>
<tr><th>Hub</th><th>Switch</th></tr>
<tr><td>It uses broadcast technology.</td><td>It uses point to point technology/Unicast technology.</td></tr>
<tr><td>It send the received packet to all ports.</td><td>It only send packet to only destination port.</td></tr>
<tr><td>Hub is less intelligent device.</td><td>Switch is more intelligent device.</td></tr>
<tr><td>Hub is passive device (without Software)</td><td>Switch is active device (with software)</td></tr>
<tr><td>Hub is less expensive</td><td>Expensive</td></tr>
<tr><td>4/12 port</td><td>24/48 ports</td></tr>
<tr><td>Manufacturers are: Sun Systems, Oracle and Cisco</td><td>Manufacturers are: Cisco and D-Link</td></tr>
<tr><td>It cannot learn or store MAC address.</td><td>Switch store MAC address in lookup table.</td></tr>
</table>
</td><td>2 M for any two relevant points</td></tr>
<tr><td></td><td>c</td><td>Define meaning of layered approach.</td><td>2 M</td></tr>
<tr><td></td><td>Ans</td><td>Layered Approach: The complex task of communication is broken into simpler subtask or modules. Each layer performed a subset of the required communication function.</td><td></td></tr>
<tr><td></td><td>d</td><td>State the application of computer network.</td><td>2 M</td></tr>
<tr><td></td><td>Ans</td><td>• Marketing and sales
• Financial services
• Information services
• Banking
• Television
• E-mail
• Electronic data interchange(EDI)
• Teleconferencing</td><td>2 M any four</td></tr>
<tr><td></td><td>e</td><td>List any four application layer protocol.</td><td>2 M</td></tr>
<tr><td></td><td>Ans</td><td>• SMTP-Simple mail transfer protocol.
• POP- Post office protocol
• HTTP- Hypertext transfer protocol.
• FTP- File transfer protocol.
• TELNET-Terminal Network
• DNS- Domain Name system BOOTP-BOOT protocol</td><td>2 M for any four</td></tr>
<tr><td></td><td>f</td><td>Define IP address. State IP addresses classes.</td><td>2 M</td></tr>
<tr><td></td><td>Ans</td><td>IP address: An Internet Protocol address (IP address) is a numerical label assigned to each device connected to a computer network that uses the Internet Protocol for communication.
Or
An IP address is an address used to uniquely identify a device on an IP network.</td><td>Definition 1 M, List classes 1 M</td></tr>
</table>

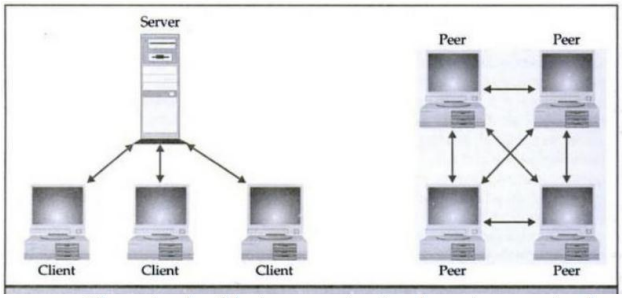
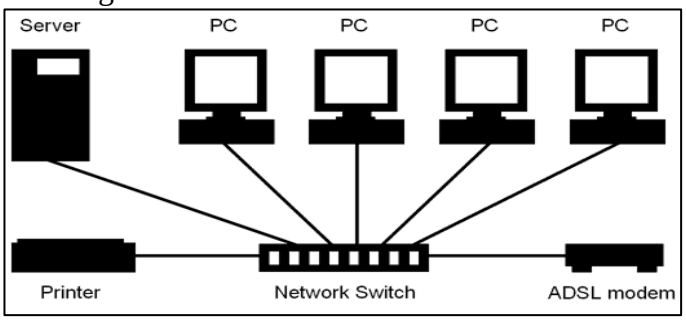
		Classes: Class A Class B Class C Class D Class E	
	g	**Draw following topology with five Host:** **(i) Ring** **(ii) Mesh Topology**	**2 M**
	Ans	 **Ring Topology**  **Mesh topology**	1 M for Ring Topology, 1 M for Mesh topology
2		**Attempt any Three of the following:**	**12 M**
	a	**Draw constructional structure of fiber optic cable. Write any four features.**	**4 M**
	Ans		2 M Diagram, 2 M Features

		OR  **Features of Fiber optic cable:** • Long-haul trunks-increasingly common in telephone network (Sprint ads) • Metropolitan trunks-without repeaters (average 8 miles in length) • Rural exchange trunks-link towns and villages • Local loops-direct from central exchange to a subscriber (business or home) • Local area networks-100Mbps ring networks.	
	b	**Draw TCP/IP reference model. Write the function of each layer.**	**4 M**
	Ans	 The TCP/IP Model TCP/IP Reference Model is a four-layered suite of communication protocols. **The four layers in the TCP/IP protocol suite are:** • **Host-to- Network Layer**: It is the lowest layer that is concerned with the physical transmission of data. TCP/IP does not specifically define any protocol here but supports all the standard protocols. • **Internet Layer**: It defines the protocols for logical transmission of data over the network. The main protocol in this layer is Internet Protocol (IP) and it is supported by the protocols ICMP, IGMP, RARP, and ARP. • **Transport Layer**: It is responsible for error-free end-to-end delivery of data. The protocols defined here are Transmission Control Protocol (TCP) and User Datagram Protocol (UDP).	2 M TCP/IP Model, 2M functions of layer.

		• **Application Layer:** This is the topmost layer and defines the interface of host programs with the transport layer services. This layer includes all high-level protocols like Telnet,HTTP, FTP, SMTP, etc.	
	c	**Describe the working of following OSI Model:** **(i)Data Link layer** **(ii) Network layer**	**4 M**
	Ans	**Data link layer:** Data link layer is responsible for converting data stream to signals bit by bit and to send that over the underlying hardware. At the receiving end, Data link layer picks up data from hardware which are in the form of electrical signals assembles them in a recognizable frame format, and hands over to upper layer. **Function of data link layer:** • **Framing:** Data-link layer takes packets from Network Layer and encapsulates them into Frames. Then, it sends each frame bit-by-bit on the hardware. At receiver' end, data link layer picks up signals from hardware and assembles them into frames. • **Addressing**: Data-link layer provides layer-2 hardware addressing mechanism. Hardware address is assumed to be unique on the link. It is encoded into hardware at the time of manufacturing. • **Synchronization:** When data frames are sent on the link, both machines must be synchronized in order to transfer to take place. • **Error Control:** Sometimes signals may have encountered problem in transition and the bits are flipped. These errors are detected and attempted to recover actual data bits. It also provides error reporting mechanism to the sender. • **Flow Control:** Stations on same link may have different speed or capacity. Data-link layer ensures flow control that enables both machines to exchange data on same speed. • **Multi-Access:** When host on the shared link tries to transfer the data, it has a high probability of collision. Data-link layer provides mechanism such as CSMA/CD to equip capability of accessing a shared media among multiple Systems. **Network layer:** The network layer (Layer 3) controls the source to destination delivery of data packets across multiple hops (nodes). It	2 M for DLL 2 M for Network layer

		controls the operation of the subnet. **The main functions of the network layer are as follows:** • It is responsible for routing packets from the source host to the destination host. The routes can be based upon static tables that are rarely changed, or they can be automatically updated depending upon network conditions. • The data link layer assigns the physical address locally. When the data packets are routed to remote locations, a logical addressing scheme is required to differentiate between the source system and the destination system. This is provided by the network layer. • This layer also provides mechanisms for congestion control. • The network layer tackles issues like transmission delays, transmission time, avoidance of jitters, etc.	
	d	**Describe the Host –to –network layer protocol Slip and PPP.**	**4 M**
	Ans	SLIP means **Serial Line Internet Protocol**. SLIP is the result of the integration of modem protocols prior to the suite of TCP/IP protocols. It is a simple Internet link protocol conducting neither address nor error control, which is the reason that it is quickly becoming obsolete in comparison to PPP. 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 (i.e. the **END** character, the ASCII code 192). A SLIP frame looks like this: PPP means **Point to Point Protocol**. It is a much more developed protocol than SLIP (which is why it is replacing it), insofar as it can transfer additional data and is better suited to data transmission over the Internet. (The addition of data in a frame is mainly due to the increasing bandwidth). In reality, PPP is a collection of three protocols: a datagram encapsulation protocol; an **LCP**, or **Link Control Protocol**, enabling testing and communication configuration; a collection of **NCPs**, or **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 they can also be different (hence the specific designation of packet instead of datagram). As such, one field of the frame is reserved for the type of protocol to which the packet belongs. A PPP frame looks like this:	2 M for SLIP, 2 M For PPP

		 The padding data is used to adapt the length of the frame for certain protocols. A PPP session (from opening to closure) takes place as follows. Upon connection, an LCP packet is sent. In the event of an authentication request from the server, a packet relating to an authentication protocol may be sent i.e. </bold>PAP (Password Authentication Protocol), CHAP (Challenge Handshake Authentication Protocol), or Kerberos. Once communication is established, PPP sends configuration information using the NCP protocol. Datagrams to be sent are transmitted as packets. Upon disconnection, an LCP packet is sent to end the session.	
3		**Attempt any three of the following:**	**12 M**
	a	**State the classification of network based on:** **i) Transmission technology** **ii) Network Relationship**	**4 M**
	Ans	**Classification of networks based on transmission technology:** **The can be categorized broadly into two types:** • **Broadcast networks:** Broadcast networks have a single communication channel that is shared or used by all the machines on the network. Short messages called packets sent by any machine are received by all the others. Broadcast systems generally use a special code in the address field for addressing a packet to all the concerned computers. This mode of operation is called broadcasting. • **Point-to-point networks:** Point to point networks consists of many connections between individual pairs of machines. To go from the source to the destination a packet on these types of network may have to go through intermediate computers before they reach the desired computer. **Classification of networks based on Network Relationship:** **i)Client Server network** **ii) Peer to peer network** • **Client Server Network:** In this network, a centralized computer, server is used for sharing the resources and providing services to other computers, clients. Thus the name Client Server. The servers stores all the network's shared files and applications programs, such as word processor documents,	2 M for transmission technology and 2 M for Network Relationship.

		compilers, database applications, spreadsheets, and the network operating system. Client will send request to access information from the server. Based on the request, server will send the required information to the client.  **Figure showing Client server network and peer to peer network** • **Peer to peer network:** In this type of network, each computer/node shares its resources using its own file system. There are no servers required in this network. Thus there is no centralized management, but each system owns its resources and services to be shared with other computers.	
	b	**Write any two specifications of following:** **i)Switch** **ii)Router**	**4 M**
	Ans	**Switch:** • A switch is a multi-port bridge with a buffer and a design that can boost its efficiency (large number of ports implies less traffic) and performance. • Switch is data link layer device. Switch can perform error checking before forwarding data that makes it very efficient as it does not forward packets that have errors and forward good packets selectively to correct port only. • In other words, switch divides collision domain of hosts, but broadcast domain remains same. • The basic function that any switch is supposed to perform is to receive information from any source connected to it and dispatch that information to the appropriate destination only. This thing differentiates switches from hubs.  	Any two specifications of switch: 2 M Any two specifications of Router: 2 M

Router:

- Router is network layer device that routes packets based on their logical address (host to host address).
- Router normally connects LAN and WANS in the internet using route information stored in routing table Routing table of router is tabular database which stores information about destination and path (next Hop address through with to reach) information routing table is updated dynamically depending on changes in network.
- Messages are stored in the routers before re-transmission, routers are said to implement a store-and-forward technique.

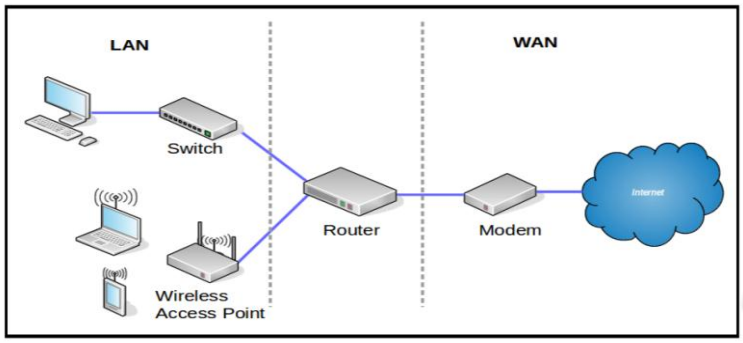


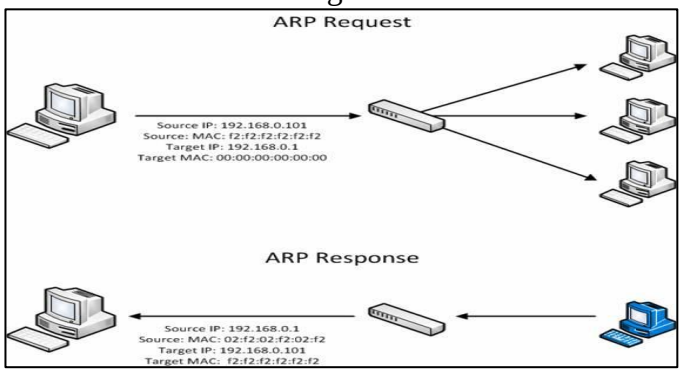
Fig: Router

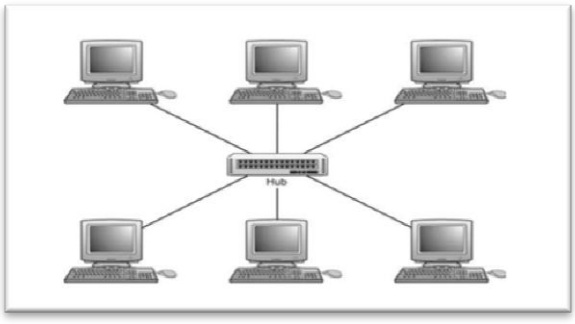
Two types of routers are:

1. **Static routers**: A router with manually configured routing tables is known as a static router.

2. Dynamic routers: A router with dynamically configured routing tables is known as a dynamic router. Dynamic routing consists of routing tables that are built and maintained automatically through an ongoing communication between routers.

	c	**Describe major functions of Transport layer in TCP/IP model.**	**4 M**
	Ans	**Functions of Transport Layer** 1. **Service Point Addressing**: Transport Layer header includes service point address which is port address. This layer gets the message to the correct process on the computer unlike Network Layer, which gets each packet to the correct computer. 2. **Segmentation and Reassembling**: A message is divided into segments; each segment contains sequence number, which enables this layer in reassembling the message. Message is reassembled correctly upon arrival at the destination and replaces packets which were lost in transmission. 3. **Connection Control:** It includes 2 types: o **Connectionless Transport Layer**: Each segment is considered as an independent packet and delivered to the	Any 4 functions (1 function 1 M)

		transport layer at the destination machine. ○ **Connection Oriented Transport Layer**: Before delivering packets, connection is made with transport layer at the destination machine. **4. Flow Control:** In this layer, flow control is performed end to end. **5. Error Control**: Error Control is performed end to end in this layer to ensure that the complete message arrives at the receiving transport layer without any error. Error Correction is done through retransmission.	
	d	**Describe the function of ARP with suitable diagram.**	**4 M**
	Ans	• Address Resolution Protocol (ARP) • ARP is a network-layer protocol. • ARP maps IP address to its corresponding MAC address. • The sender knows the IP address of the target; and it wants to know the hardware address of the target. • So, the sender creates an ARP request message in which it fills the following fields: ○ Sender Hardware Address ○ Sender IP address ○ Target IP Address • 'Target Hardware Address' field is filled with 0's since it does not know that. • This ARP request message is broadcast to all hosts on the network. • All hosts on the network receive and process the ARP packet. Only the host whose IP address matches with the value in the 'Target IP address' field sends an ARP reply. • The ARP reply message sent by the target machine contains its hardware address. This ARP reply is unicast. • The sender receives this reply message and now it knows the hardware address of the target machine. 	1 M diagram and 3 M explanation

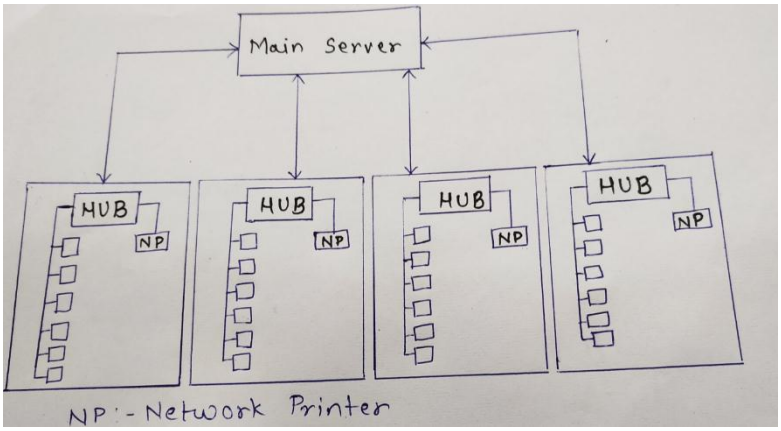
4		**Attempt any three of the following:**	**12 M**
	a	**Describe any four benefits of Computer Network.**	**4 M**
	Ans	**Benefits of computer network:** • **File sharing:** Computer networks allow file sharing and remote file access. A person sitting at one workstation connected to a network can easily see files present on another workstation, provided he/she is authorized to do so. • **Resource Sharing:** A computer network provides a cheaper alternative by the provision of resource sharing. All the computers can be interconnected using a network and just one modem & printer can efficiently provide the services to all users. • **Inexpensive set-up:** Shared resources means reduction in hardware costs. Shared files means reduction in memory requirement, which indirectly means reduction in file storage expenses. • **Flexible Handling:** A user can log on to a computer anywhere on the network and access his/her files. This offers flexibility to the user as to where he/she should be during the course of his/her routine. Centralized Management- Networking allows the management of various resources in the organization, centrally through architectures such as client server architecture. • **Backing up data:** Creating backup files and restoring them becomes much easier using computer networks. • **E-mail Services:** E-mail is extremely valuable & important feature for communication within organization or outside the people in world. Networking allows file based or client based systems for communication.	Any 4 benefits (1 benefit 1 M)
	b	**Describe star topology with suitable diagram. List two advantages of star topology.**	**4 M**
	Ans	**Star Topology:**  **Star Topology**	2 M for explanation and 1 M for diagram and 1 M for advantages

		• In a star topology, each device has a dedicated point-to-point link only to a central controller, usually called a hub. The devices are not directly linked to one another. • A star topology does not allow direct traffic between devices. The controller acts as an exchange. If one device wants to send data to another, it sends the data to the controller, which then relays the data to the other connected device. A star topology is less expensive than a mesh topology. • In a star, each device needs only one link and one I/O port to connect it to any number of others. This factor also makes it easy to install and reconfigure. • One big disadvantage of a star topology is the dependency of the whole topology on one single point, the hub. If the hub goes down, the whole system is dead. Although a star requires far less cable than a mesh, each node must be linked to a central hub. The star topology is used in local-area networks (LANs). High-speed LANs often use a star topology with a central hub. **Advantages of star topology**: • Centralized management allows better monitoring the network • Easy to manage as connection of nodes and removing can be done easily, without affecting the network. • Failure of one link doesn't affect the rest of the network. • Easy to detect the failure and troubleshoot. • Better performance as the signal sent by the node doesn't necessarily get transmitted to all workstations.	
	c	**Write stepwise procedure to share file on network.**	**4 M**
	Ans	**Step 1: Create File** Create a file/folder on the desktop. **Step 2: Advanced Sharing** Right-click on the file, select properties. Click over to the "Sharing" tab and select advanced sharing. Check the box marked "Share folder". **Step 3: Permissions** Select which permissions you want other users to have for this file. You will retain full access, but others will have either read-only, edit, or executable permissions, depending on what you select. **Step 4: Open Sharing** Go to control panel, select network & internet, then select network & sharing center. Go to Advanced sharing settings. Scroll down, and select "Turn on sharing so anyone with network access can read and write files in the Public folders" and "Turn off password protected sharing".	4 M for relevant steps

		Step 5: Accessing the File On the 2nd PC, open file explorer. Go to network. Your file should be there.	
	d	**Calculate broadcast address for the following:** **i) Network of class 'C' with network address 192.168.10.0** **ii) Network of class 'B' with network address 172.16.20.0**	**4 M**
	Ans	Network address: 192.168.10.0 Net mask: 255.255.255.0 = 24 Therefore, we can represent it as, 192.168.10.0/24 In Binary: Network address : 11000000.10101000.00001010.00000000 Subnet mask : 11111111.11111111.11111111.00000000 Inverse Mask : 00000000.00000000.00000000.11111111 Broadcast address : 11000000.10101000.00001010.11111111 Broadcast address in decimal: 192.168.10.255 Network address: 172.16.20.0 Net mask: 255.255.0.0 = 16 Therefore, we can represent it as, 172.16.0.0/16 In Binary: Network address : 10101100.00010000.00010100.00000000 Subnet mask : 11111111.11111111.00000000.00000000 Inverse Mask : 00000000.00000000.11111111.11111111 Broadcast address : 10101100.00010000.11111111.11111111 Broadcast address in decimal: 172.16.255.255	2 M each
	e	**State difference between peer to peer and client server network.**	**4 M**
	Ans		1 M each

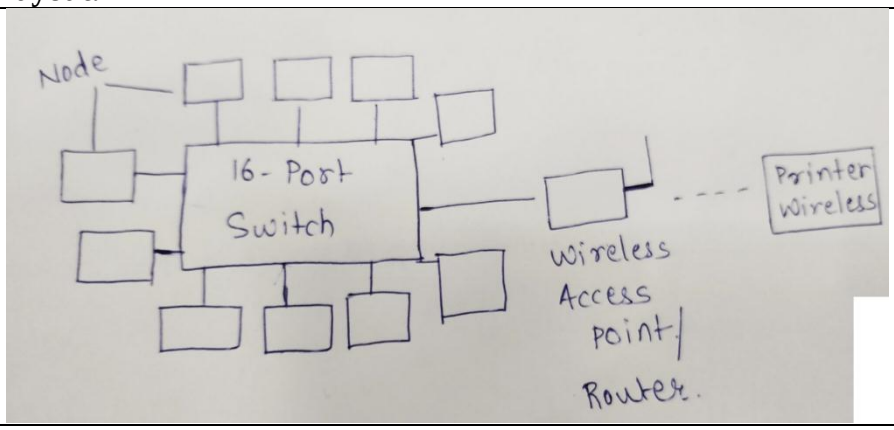
Peer to peer Network	**Client Server Network**
1. It is much like company uses decentralized management	1. It is much like company uses centralized management.
2.In this each machine has same power	2. In this server has more power & client has less power.
3. Uses less expensive computer hardware.	3.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

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td>Attempt any three of the following:</td><td>12 M</td></tr>
<tr><td></td><td>a</td><td>Write step wise procedure to configure DHCP server.</td><td>6 M</td></tr>
<tr><td></td><td>Ans</td><td>Steps to configure DHCP server:
When the client detects it has connected to the DHCP server, it send the DHCPDISCOVER request.
The router either receives the request or redirects it to the appropriate DHCP server.
If the server accepts the new device, it will send a DHCPOFFER message back to the client which contains the client device's MAC address and the IP address being offered.
The client returns the DHCPREQUEST message to the server confirming it will use the IP Address.
Finally, server responds with a DHCPACK acknowledgement message that confirms the client has been given access for a certain amount of time.</td><td>Proper steps
6 M</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>b</td><td>State difference between IPv4 and IPv6.</td><td>6</td></tr>
<tr><td></td><td>Ans</td><td><table><tr><th>IPv4</th><th>IPv6</th></tr><tr><td>Source and Destination addresses are 32 bits in length.</td><td>Source and Destination addresses are 128 bits in length.</td></tr><tr><td>IPv4 addresses are binary numbers represented in decimals.</td><td>IPv6 addresses are binary numbers represented in hexadecimals.</td></tr><tr><td>IPsec supports in optional</td><td>IPsec support is required.</td></tr><tr><td>Security is dependent on application.</td><td>IPsec is inbuilt in IPv6 protocol.</td></tr><tr><td>No packet flow identification.</td><td>Packet flow identification is available within the IPv6 header using flow label field</td></tr><tr><td>Header includes a checksum.</td><td>Header does not include a checksum.</td></tr><tr><td>Encryption and Authentication is not provided.</td><td>Encryption and Authentication is provided.</td></tr><tr><td>Must be configured either manually or through DHCP.</td><td>Does not require manual configuration or DHCP.</td></tr><tr><td>Header includes options.</td><td>All optional data is moved to IPv6extension headers.</td></tr><tr><td>Most support a 576 byte packet size.(Usually fragmented)</td><td>Must support 1280 byte packet size(Without Fragmentation)</td></tr></table></td><td>Any Six Points: 1 Point one M</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>c</td><td>Design suitable network layout for an organization with four departments (6 users each), shared print server and network printer.</td><td>6 M</td></tr>
</table>

	Ans		Any relevant diagram: 6 M
6		**Attempt any three of the following:**	**12 M**
	a	**Differentiate between OSI Model and TCP/IP Model.**	**6**
	Ans		Any Six Points: 1 Point one M

OSI	**TCP/IP**
OSI is a generic, protocol independent standard, acting as a communication gateway between the network and end User.	TCP/IP model is based on standard Protocols around which the Internet has developed. It is a communication protocol, which allows connection of hosts over a network.
In OSI model the transport layer Guarantees the delivery of packets.	In TCP/IP model the transport layer does not guarantee delivery of packets. Still the TCP/IP model is more reliable.
Follows vertical approach.	Follows horizontal approach.
OSI model has a separate Presentation layer and Session layer.	TCP/IP does not have a separate Presentation layer or Session layer.
OSI is a reference model around Which the networks are built. Generally, it is used as a guidance Tool.	TCP/IP model is, in a way implementation of the OSI model.
Network layer of OSI model provides both connection oriented And connectionless service.	The Network layer in TCP/IP model Provides connectionless service.
OSI model has a problem of	TCP/IP model does not fit any

		fitting the protocols into model. | protocol	
	b	**Design a network class 'c' with network address 192.156.5.0 with 2 subnet. State the subnet mask and subnet address.**	**6**
	Ans	192.156.5.0/2 In Binary IP Address: 11000000 10011100 0000001 00000000 We will use class C address which takes 1 bit from Host field for subnetting and leaves 7 bits for defining hosts. Having 7 bits available for defining subnets means we have up to $2(2^1)$ different subnets. 8 bits 8 bits 8 bits 8 bits N/W | N/W | N/W | N/W 8 bits 8 bits 8 bits 1 bit 7 bits N/W | N/W | N/W | Subnet | Host Let's use IP address 192.156.5.0 with subnet mask 255.255.255.128 **Step 1: convert to binary** 192 156 5 0 11000000 10011100 00000101 00000000 255 255 255 128 11111111 11111111 11111111 100000000 **Subnet Mask is: 255.255.255.128** **Step 2: Calculate subnet address** To calculate the subnets IP address you need to perform bit wise AND operation (1+1=1, 1+0=0 or 0+1=0, 0+0=0) on the host IP address and subnet mask: IP address: 11000000 10011100 00000101 00000000 AND 11111111 11111111 11111111 10000000 --- 11000000 10011100 00000101 00000000 **Subnet Address is: 192.156.5.0**	Design: 2 M, Subnet Mask: 2 M , Subnet Address: 2 M

	c	**Draw Suitable network layout with star topology for a computer lab with 10 hosts and a wireless printer. List all components in the layout.**	**6 M**
	Ans		Any relevant diagram: 6M