



V2V EDTECH LLP

Online Coaching at an Affordable Price.

OUR SERVICES:

- Diploma in All Branches, All Subjects
- Degree in All Branches, All Subjects
- BSCIT / CS
- Professional Courses

 **+91 93260 50669**

 **v2vedtech.com**

 **V2V EdTech LLP**

 **v2vedtech**



SUMMER – 2023 EXAMINATION
Model Answer – Only for the Use of RAC Assessors

Subject Name: Data Communication and Computer Network

Subject Code: 22414

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.
- 8) As per the policy decision of Maharashtra State Government, teaching in English/Marathi and Bilingual (English + Marathi) medium is introduced at first year of AICTE diploma Programme from academic year 2021-2022. Hence if the students in first year (first and second semesters) write answers in Marathi or bilingual language (English +Marathi), the Examiner shall consider the same and assess the answer based on matching of concepts with model answer.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1		Attempt any <u>FIVE</u> of the following:	10 M
	a)	Define computer Network.	2 M
	Ans	Computer networking refers to interconnected computing devices that can exchange data and share resources with each other. A network connection between these devices can be established using cable or wireless media.	Correct definition 2 M (other definition of computer network can be considered)
	b)	Describe data communication standards.	2 M
	Ans	Standards provide guidelines to manufacturers, vendors, government agencies, and other service providers to ensure the kind of interconnectivity necessary in today's marketplace and in international communications. De Facto Standard : The meaning of the work " De Facto " is " By Fact " or "By Convention". These standards have not been approved by any Organization, but have been adopted as Standards because of its widespread use. In addition, sometimes Manufacturers often establish these standards. For example: Apple and Google are two companies, which established their own	1 M for De Facto Standard and 1 M for De Jure Standard



	<p>rules on their products, which are different. In addition, they use some same standard rules for manufacturing for their products.</p> <p>De Jure Standard: The meaning of the word “<i>De Jure</i>” is “By Law” or “By Regulations”.</p> <p>Thus, these standards have been approved by officially recognized body like ANSI, ISO, and IEEE etc. These are the standard, which are important to follow if it is required or needed.</p> <p>For example : All the data communication standard protocols like SMTP , TCP , IP , UDP etc. are important to follow the same when we needed them.</p>	
c)	State any two types of unguided media.	2 M
Ans	<p>1) Radio wave</p> <p>2) Infrared</p> <p>3) Microwave</p>	Any 2 types 2 M
d)	State any two limitations in Bluetooth	2 M
Ans	<p>It has low bandwidth as compared to Wi-Fi.</p> <p>It allows only short range communication between devices.</p> <p>Security is a very key aspect as it can be hacked.</p>	Any 2 correct limitations 2 M
e)	Describe single Bit error and Burst error.	2 M
Ans	<p>Single-Bit Error : The term single-bit error means that only 1 bit of a given data unit (such as a byte, character, or packet) is changed from 1 to 0 or from 0 to 1.</p> <div style="text-align: center;"> <p>Fig: Single bit error</p> </div> <p>Burst Error: The term burst error means that 2 or more bits in the data unit have changed from 1 to 0 or from 0 to 1.</p> <div style="text-align: center;"> <p>Fig: Burst Error</p> </div>	1 M for single bit and 1 M for Burst error
f)	List any four Network connecting devices.	2 M
Ans	<p>1) Hub 2) Switch 3) Router 4) Bridge</p>	Any 4 devices



		5) Gateway 6) Modem 7) Repeater 8) Access Point 9) NIC(Network Interface Card)	(½ M for each device)
	g)	List any four application layer protocol.	2 M
	Ans	1. Simple Mail Transfer Protocol (SMTP) 2. File Transfer Protocol (FTP) 3. Hyper Text Transfer Protocol (HTTP) 4. Trivial File Transfer Protocol (TFTP) 5. TE Letype NE Twork (TELNET) 6. Simple Network Management Protocol 7. Dynamic Host Configuration Protocol (DHCP)	Any 4 protocol (½ M for each application layer protocol)
2.		Attempt any <u>THREE</u> of the following:	12 M
	a)	Explain the components of Data communication.	4 M
	Ans	<p>A data communications system has five components:</p> <ol style="list-style-type: none"> 1) Message: The message is the information (data) to be communicated. Popular forms of information include text, numbers, pictures, audio, and video. 2) Sender: The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on. 3) Receiver: The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on. 4) Transmission medium: The transmission medium is the physical path by which a message travels from sender to receiver. Some examples of transmission media include twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves. 5) Protocol: A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but not communicating. <div style="text-align: center; margin-top: 20px;"> </div> <p style="text-align: center; margin-top: 10px;">Fig: Components of Data Communication</p>	1 M diagram 3 M explanation of components
	b)	Describe Propagation modes in fibre optic cable.	4 M
	Ans	A) Multimode:	2 M for Multimode with



Multimode is so named because multiple beams from a light source move through the core in different paths. How these beams move within the cable depends on the structure of the core.

Multimode having 2 types of modes:

- 1) Multimode step-index fiber
- 2) Multimode graded-index fiber

In multimode step-index fiber, the density of the core remains constant from the center to the edges.

The term step index refers to the suddenness of this change, which contributes to the distortion of the signal as it passes through the fiber. (refer fig a)

A second type of fiber, called **multimode graded-index fiber**, decreases this distortion of the signal through the cable. The word index here refers to the index of refraction. As we saw above, the index of refraction is related to density. (refer fig b)

B) Single-Mode

Single-mode uses step-index fiber and a highly focused source of light that limits beams to a small range of angles, all close to the horizontal.

In this case, propagation of different beams is almost identical, and delays are negligible.

All the beams arrive at the destination "together" and can be recombined with little distortion to the signal. (refer fig c)

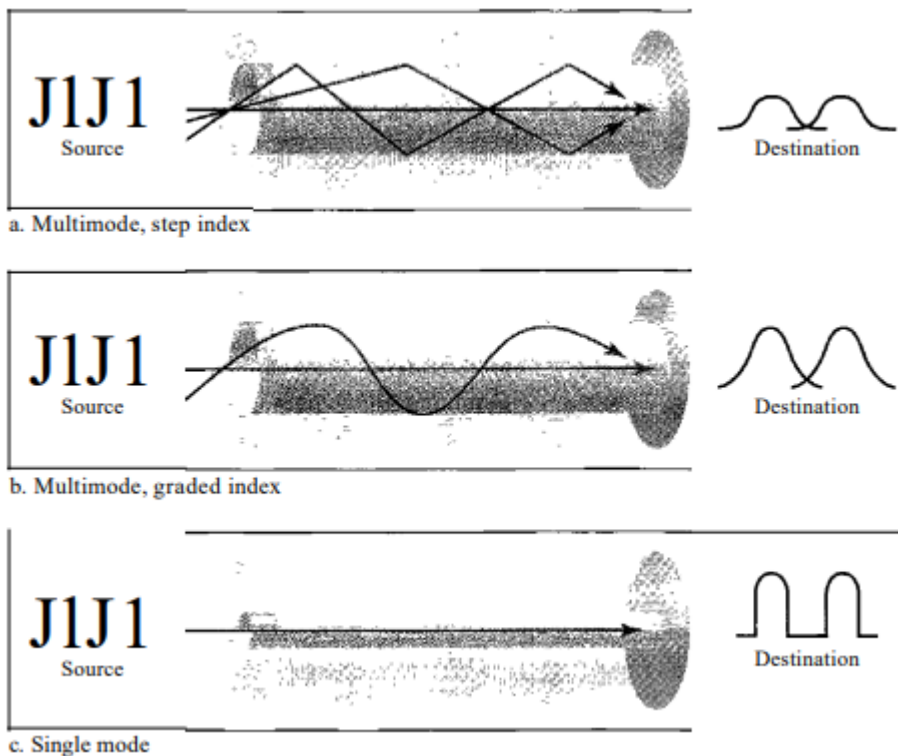


diagram and 2
M for Single
mode with
diagram



fig: Propagation modes																		
c)	Compare 3G and 4G mobile Generations on the basis of data speed, technology, standard and services.		4 M															
Ans	<table border="1"> <thead> <tr> <th>Parameters</th> <th>3G</th> <th>4G</th> </tr> </thead> <tbody> <tr> <td>Data speed</td> <td>2 Mbps - 21 Mbps</td> <td>2 Mbps - 1 Gbps</td> </tr> <tr> <td>Technology</td> <td>The technology used in 3G is WCDMA (Wideband Code Division Multiple Access), Digital Broadband Packet Data CDMA 2000, UMTS, EDGE, etc.</td> <td>The technology used in 4G is LTE (Long-Term Evolution), and WiMAX (Worldwide Interoperability for Microwave Access).</td> </tr> <tr> <td>Standard</td> <td>IMT2000 3.5G HSDPA 3.75G HSUPA</td> <td>Single Unified standard Wimax and LTE</td> </tr> <tr> <td>Services</td> <td>CDMA 2000, UMTS, EDGE etc</td> <td>Wimax2 and LTE-Advance</td> </tr> </tbody> </table>		Parameters	3G	4G	Data speed	2 Mbps - 21 Mbps	2 Mbps - 1 Gbps	Technology	The technology used in 3G is WCDMA (Wideband Code Division Multiple Access), Digital Broadband Packet Data CDMA 2000, UMTS, EDGE, etc.	The technology used in 4G is LTE (Long-Term Evolution), and WiMAX (Worldwide Interoperability for Microwave Access).	Standard	IMT2000 3.5G HSDPA 3.75G HSUPA	Single Unified standard Wimax and LTE	Services	CDMA 2000, UMTS, EDGE etc	Wimax2 and LTE-Advance	For each parameter 1 M
	Parameters	3G	4G															
	Data speed	2 Mbps - 21 Mbps	2 Mbps - 1 Gbps															
	Technology	The technology used in 3G is WCDMA (Wideband Code Division Multiple Access), Digital Broadband Packet Data CDMA 2000, UMTS, EDGE, etc.	The technology used in 4G is LTE (Long-Term Evolution), and WiMAX (Worldwide Interoperability for Microwave Access).															
	Standard	IMT2000 3.5G HSDPA 3.75G HSUPA	Single Unified standard Wimax and LTE															
Services	CDMA 2000, UMTS, EDGE etc	Wimax2 and LTE-Advance																
d)	Describe the process of DHCP server configuration.		4 M															
Ans	<p>A DHCP server (Dynamic Host Configuration Protocol) is a server that automatically assigns IP addresses to computers and other devices on the network. Without a DHCP server, each device on the network would need to be manually configured with an IP address.</p> <p>Process of DHCP server configuration</p> <p><u>Step 1: Open Server Manager</u> Click the start button then click the Server Manager</p> <p><u>Step 2: Add roles and features</u> On the server manager dashboard click “Add roles and features” This will start the add roles and features wizard. Click next on the before you begin page.</p> <p><u>Step 3: Select Role-based or feature-based installation</u> Make sure “Role-based or feature-based installation is selected and click next</p> <p><u>Step 4: Select destination server</u> On this page, choose the server you want the DHCP service installed on.</p>		<p>Correct process of DHCP server configuration 4 M</p> <p>(any relevant process can be considered)</p>															



Step 5: Select server roles

On this page, you want to select the DHCP server roles and click next.

When you select the roll you will get a pop up asking to add features that are required for DHCP server. Click add features

Back on the select server roles page click next

Step 6: Feature, DHCP Server

On the features, screen click next.

On the DHCP server click next.

Step 7: Confirmation

On the confirmation page, you can select to automatically restart the server if required.

On 2016 server, it does not require a restart.

Configure DHCP Server

If you followed, the steps above you should now have the DHCP service installed.

But, It still needs to be configured.

Step 1: Server Manager

In the server manager dashboard, you will see a yellow notification at the top left.

Click on it

Now click on “Complete DHCP configuration”

Step 2: Post-Install configuration wizard

On the description screen click next

On the authorization page use AD credentials if the server is joined to the domain.

Choose “Skip AD authorization” if the DHCP server is standalone and not joined to the domain.

Click commit

You will see a summary page of the configuration steps

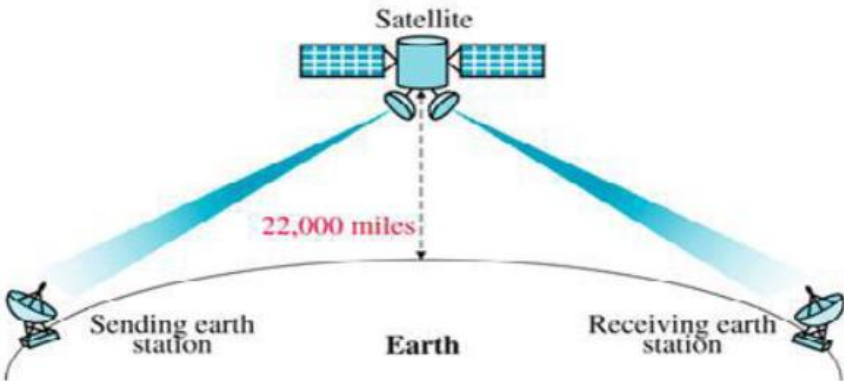
Click close

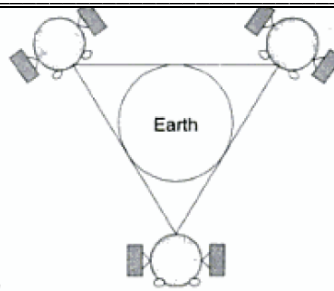
Now you can open the DHCP management console to configure DHCP scopes and other options.

To access the DHCP management console click start -> Windows Administrative Tool
-> DHCP

The next steps are to configure a new scope, configure scope options and ensure clients can access the DHCP server.



3.	Attempt any THREE of the following:	12 M
a)	Describe Satellite communication with neat diagram.	4 M
Ans	<p>SATELLITE COMMUNICATION:</p> <p>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</p> <p style="text-align: center;">Satellite Communication</p>  <p>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.</p> <p>Therefore Geosynchronous satellites are used which move at same RPM as that of the earth in the same direction.</p> <p>So the relative position of the ground station with respect to the satellite never changes.</p> <p>However 3 satellites are needed to cover earth's surface entirely.</p>	2 M Diagram and 2M Explanation



Frequency band used in satellite communication:

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

Application of satellite:

- Satellite television
- digital cinema
- satellite radio
- satellite internet access

b) Describe modes of communication.

4 M

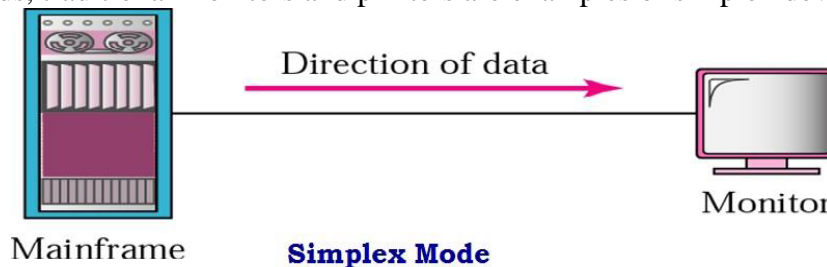
Ans Transmission mode refers to the mechanism of transferring of data between two devices connected over a network. It is also called Communication Mode. These modes direct the direction of flow of information. There are three types of transmission modes.

They are:

- Simplex Mode
- Half duplex Mode
- Full duplex Mode

In Simplex mode, the communication is unidirectional, as on a one-way street. Only one of the two devices on a link can transmit; the other can only receive. The simplex mode can use the entire capacity of the channel to send data in one direction.

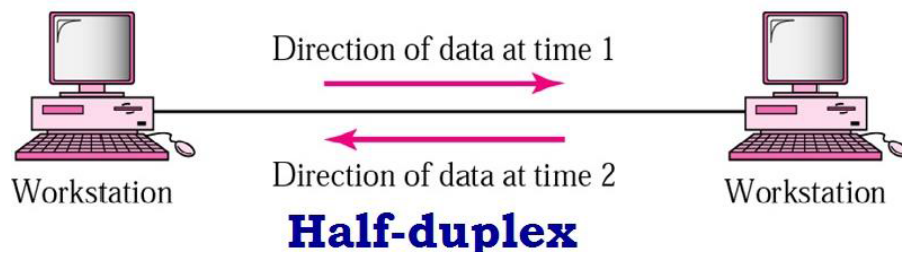
-Keyboards, traditional monitors and printers are examples of simplex devices.



In half-duplex mode, each station can both transmit and receive, but not at the same time. When one device is sending, the other can only receive, and vice versa. The half-duplex mode is used in cases where there is no need for

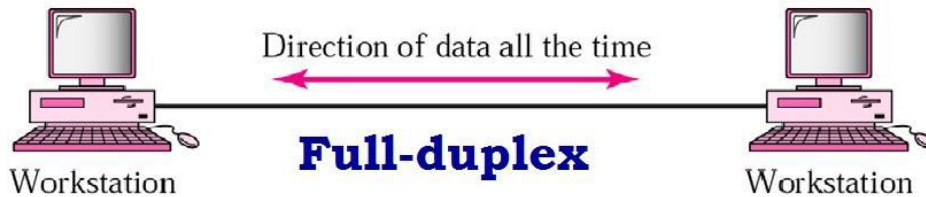
Modes of Communication-
1 M, Diagram and Explanation-
1 M each

communication in both directions at the same time. The entire capacity of the channel can be utilized for each direction
-for example :Walkie-talkies.



In full-duplex mode both stations can transmit and receive data simultaneously. The transmission medium sharing can occur in two ways, namely, either the link must contain two physically separate transmission paths or the capacity of the channel is divided between signals traveling in both directions.

-One common example of full-duplex communication is the telephone network. When two people are communicating by a telephone line, both can talk and listen at the same time.



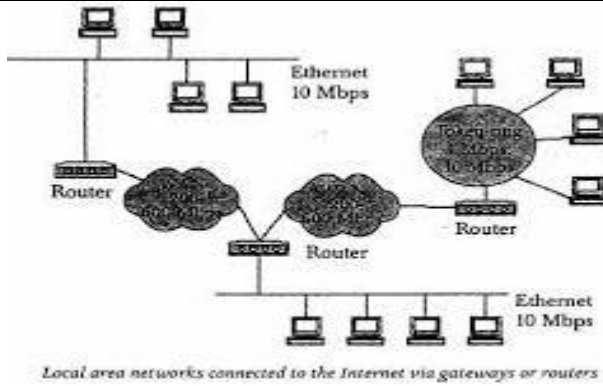
c) **Describe the working of Router with suitable diagram.**

4 M

Ans 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.

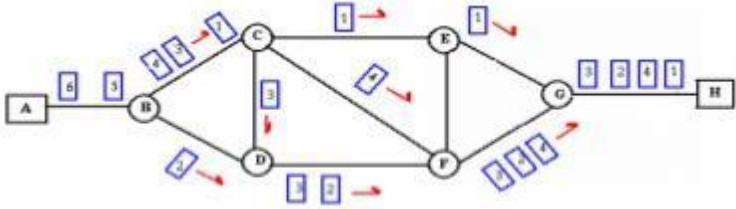
- 1) Router use logical and physical addressing to connect two or more logically separate networks.
- 2) They accomplish this connection by organizing the large network into logical network called subnets.
- 3) Each of the subnet is given a logical address. This allows the network to be separate but still access to each other and exchange data.
- 4) Data is grouped into packets. Each packet has physical device address and logical network address.

2 M Diagram
and 2 M
Explanation



	d)	Name the Protocols used in i) Data Link Layer ii) Network Layer iii) Transport Layer iv) Presentation Layer	4 M												
	Ans	<p>Data Link Layer: ARP, CSLIP, HDLC, IEEE.802.3, PPP, X-25, SLIP, ATM, SDLS and PLIP.</p> <p>Network Layer: Internet Protocol (IPv4), Internet Protocol (IPv6), IPX, AppleTalk, ICMP, IPsec and IGMP.</p> <p>Transport Layer: Transmission Control Protocol (TCP), UDP, SPX, DCCP and SCTP.</p> <p>Presentation Layer: XDR, TLS, SSL and MIME.</p>	1 M each for protocols used in various layer												
	4.	Attempt any <u>THREE</u> of the following:	12 M												
	a)	Compare FDM and TDM (Any 4 points each)	4 M												
	Ans	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Frequency Division Multiplexing</th> <th style="width: 50%;">Time division Multiplexing</th> </tr> </thead> <tbody> <tr> <td>FDM divides the channel into two or more frequency ranges that do not overlap</td> <td>TDM divides and allocates certain time periods to each channel in an alternating manner</td> </tr> <tr> <td>Frequency is shared</td> <td>Times scale is shared</td> </tr> <tr> <td>Used with Analog signals</td> <td>Used with both Digital signals and analog signals</td> </tr> <tr> <td>Interference is high</td> <td>Interference is Low or negligible</td> </tr> <tr> <td>Utilization is Ineffective</td> <td>Efficiently used</td> </tr> </tbody> </table>	Frequency Division Multiplexing	Time division Multiplexing	FDM divides the channel into two or more frequency ranges that do not overlap	TDM divides and allocates certain time periods to each channel in an alternating manner	Frequency is shared	Times scale is shared	Used with Analog signals	Used with both Digital signals and analog signals	Interference is high	Interference is Low or negligible	Utilization is Ineffective	Efficiently used	1 M each for correct comparison point
Frequency Division Multiplexing	Time division Multiplexing														
FDM divides the channel into two or more frequency ranges that do not overlap	TDM divides and allocates certain time periods to each channel in an alternating manner														
Frequency is shared	Times scale is shared														
Used with Analog signals	Used with both Digital signals and analog signals														
Interference is high	Interference is Low or negligible														
Utilization is Ineffective	Efficiently used														



	<p>b) Define IP addressing. List IP address classes with their range of addresses.</p>	<p>4 M</p>												
<p>Ans</p>	<p>Internet Protocol IP address is a number (example shown right) used to indicate the location of a computer or other device on a network using TCP/IP. These addresses are similar to those of your house; they allow data to reach the appropriate destination on a network and the Internet. There are two versions of IP addresses used today, IPv4 and IPv6</p> <p>IP address classes: There are five classes of available IP ranges: Class A, Class B, Class C, Class D and Class E, while only A, B, and C are commonly used. Each class allows for a range of valid IP addresses, shown in the following table.</p> <table border="1" data-bbox="256 575 1295 926"> <thead> <tr> <th>Class</th> <th>Address Range</th> </tr> </thead> <tbody> <tr> <td>Class A</td> <td>1.0.0.0 to 127.255.255.255</td> </tr> <tr> <td>Class B</td> <td>128.0.0.0 to 191.255.255.255</td> </tr> <tr> <td>Class C</td> <td>192.0.0.0 to 223.255.254.255</td> </tr> <tr> <td>Class D</td> <td>224.0.0.0 to 239.255.255.255</td> </tr> <tr> <td>Class E</td> <td>240.0.0.0 to 254.255.255.255</td> </tr> </tbody> </table>	Class	Address Range	Class A	1.0.0.0 to 127.255.255.255	Class B	128.0.0.0 to 191.255.255.255	Class C	192.0.0.0 to 223.255.254.255	Class D	224.0.0.0 to 239.255.255.255	Class E	240.0.0.0 to 254.255.255.255	<p>Define - 1 M; Classes - 1 M; range - 2 M</p>
Class	Address Range													
Class A	1.0.0.0 to 127.255.255.255													
Class B	128.0.0.0 to 191.255.255.255													
Class C	192.0.0.0 to 223.255.254.255													
Class D	224.0.0.0 to 239.255.255.255													
Class E	240.0.0.0 to 254.255.255.255													
	<p>c) Describe the principles of packet switching techniques with neat diagram.</p>	<p>4 M</p>												
<p>Ans</p>	<p>Packet Switching: The entire message is broken down into smaller chunks called packets. The switching information is added in the header of each packet and transmitted independently.</p> <p>It is easier for intermediate networking devices to store small size packets and they do not take much resource either on carrier path or in the internal memory of switches.</p>  <p>Packet switching enhances line efficiency as packets from multiple applications can be multiplexed over the carrier. The internet uses packet switching technique. Packet switching enables the user to differentiate data streams based on priorities. Packets are stored and forwarded according to their priority to provide quality of service.</p>	<p>2 M diagram and 2 M explanation</p>												
	<p>d) Describe OSI reference model with its Layered structure.</p>	<p>4 M</p>												
<p>Ans</p>	<p>OSI model (open system interconnection) model was developed by ISO (international standard organization)</p> <p>Function of OSI model:</p> <p>i. It provides way to understand how internetwork operates.</p>	<p>2 M Diagram and 2 M Explanation</p>												



ii. It gives guideline for creating network standard.
OSI model has 7 layers as shown in the figure.

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

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

1. **Physical layer:** It co-ordinates the functions required to transmit bit stream over physical medium. It deals with mechanical and electrical specifications of interface and transmission medium. For transmission it defines procedures and functions that devices and transmission medium has to perform

Physical characteristics of interfaces and media.

Representation of bits: Data rate(transmission rate).

Synchronization of bits.

Line configuration: Point to point or multipoint configuration should be used.

2.**Data link layer:** It is responsible for transmitting group of bits between the adjacent nodes. The group of bits is called as frame. The network layer passes a data unit to the data link layer. Header and trailer is added to the data unit by data link layer. This data unit is passed to the physical layer. Data link layer is responsible for moving frames from one node to the next.

Functions of data link layer are:

- 1) Framing
- 2) Physical addressing
- 3) Flow control
- 4) Error control
- 5) Media access control
- 6) Node to node delivery

3. **Network layer: It is responsible for routing the packets within the subnet i.e. from source to destination.** It is responsible for source e to destination delivery of individual packets across multiple networks. It ensures that packet is delivered from point of origin to destination.

Functions of network layer:

- 1) logical addressing
- 2) Routing.
- 3) Congestion control
- 4) Accounting and billing
- 5) Address transformation
- 6) Source host to destination host error free delivery of packet.



4. **Transport layer:** Responsibility of process to process delivery of message Ensure that whole message arrives in order.

Functions of Transport layer:

- 1) Service point addressing
- 2) Segmentation and reassembly
- 3) Connection control
- 4) Flow control: Flow control is performed end to end
- 5) Error control

5. **Session layer:** Establishes, maintains, and synchronizes the interaction among communication systems It is responsible for dialog control and synchronization.

Functionsof Session layer:

- 1) Dialog control
- 2) Synchronization, session and sub session
- 3) Session closure

6. **Presentation layer:** It is concerned with syntax, semantics of information exchanged between the two systems.

Functions of Presentation layer:

Translation: presentation layer is responsible for converting various formats into required format of the recipient

Encryption: Data encryption and decryption is done by presentation layer for security.

Compression and Decompression: data to be transform compressed while sending and decompress while receiving for reducing time of transmission.

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

Functions of Application layer:

- Network virtual terminal
- file transfer access and management
- mail services and directory services

e) **The following bit stream is encoded with VRC, LRC and even parity. Locate and correct the error if it is present.**

1 1 0 0 0 0 1 1	1 1 1 1 0 0 1 1
1 0 1 1 0 0 1 0	0 0 0 0 1 0 1 0
0 0 1 0 1 0 1 0	0 0 1 0 1 0 1 1
1 0 1 0 0 0 1 1	0 1 0 0 1 0 1 1
1 1 1 0 0 0 0 1	

4 M

Ans

4 M for correct Solution



		<p style="text-align: center;">Solution</p> <pre style="font-family: monospace; text-align: center;"> 1 1 1 0 1 0 1 0 1 1 1 0 0 0 0 0 1 1 0 1 1 0 1 1 1 0 1 0 1 1 0 1 0 0 0 0 ← Wrong Parity 0 0 0 1 1 1 0 1 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 0 1 1 0 0 0 1 1 1 1 ↑ Wrong Parity </pre> <p style="text-align: center; color: red;">Fourth bit of the fifth byte is in error. It should be "0".</p>	
--	--	--	--

5.	Attempt any <u>TWO</u> of the following:	12 M
-----------	---	-------------

a)	Differentiate any six point between LAN and WAN.	6 M
----	--	------------

Ans	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr style="background-color: #d3d3d3;"> <th style="width: 20%;">Attributes</th> <th style="width: 35%;">LAN</th> <th style="width: 45%;">WAN</th> </tr> </thead> <tbody> <tr> <td style="text-align: left;">Definition</td> <td>LAN is a group of devices connected in a small geographic area, such as houses, offices, or buildings.</td> <td>WAN is an arrangement of several devices attached over a network covering a broad area. A network having communication links crossing the regional, metropolitan, or national boundaries over a large distance is an example of WAN.</td> </tr> <tr> <td style="text-align: left;">Geographical Area</td> <td>LAN covers a small geographical area, and it does not require any leased telecommunication lines.</td> <td>WAN covers a large distance geographical area that usually crosses regional or metropolitan boundaries and requires leased telecommunication lines.</td> </tr> <tr> <td style="text-align: left;">Speed</td> <td>LAN provides a comparatively higher speed.</td> <td>WAN has a slower speed as compared to LAN.</td> </tr> <tr> <td style="text-align: left;">Data Transfer Rate</td> <td>LAN provides a high data transfer rate than WAN. It can reach up to 1000 Mbps.</td> <td>WAN provides a relatively slower data transfer rate. It can reach up to 150mbps.</td> </tr> <tr> <td style="text-align: left;">Ownership</td> <td>LAN is owned, managed, and used by an individual or an organization. Therefore, it is a private network.</td> <td>WAN can be either private or public. The Internet is the best example of public WAN.</td> </tr> </tbody> </table>	Attributes	LAN	WAN	Definition	LAN is a group of devices connected in a small geographic area, such as houses, offices, or buildings.	WAN is an arrangement of several devices attached over a network covering a broad area. A network having communication links crossing the regional, metropolitan, or national boundaries over a large distance is an example of WAN.	Geographical Area	LAN covers a small geographical area, and it does not require any leased telecommunication lines.	WAN covers a large distance geographical area that usually crosses regional or metropolitan boundaries and requires leased telecommunication lines.	Speed	LAN provides a comparatively higher speed.	WAN has a slower speed as compared to LAN.	Data Transfer Rate	LAN provides a high data transfer rate than WAN. It can reach up to 1000 Mbps.	WAN provides a relatively slower data transfer rate. It can reach up to 150mbps.	Ownership	LAN is owned, managed, and used by an individual or an organization. Therefore, it is a private network.	WAN can be either private or public. The Internet is the best example of public WAN.	Any six points 6 M
Attributes	LAN	WAN																		
Definition	LAN is a group of devices connected in a small geographic area, such as houses, offices, or buildings.	WAN is an arrangement of several devices attached over a network covering a broad area. A network having communication links crossing the regional, metropolitan, or national boundaries over a large distance is an example of WAN.																		
Geographical Area	LAN covers a small geographical area, and it does not require any leased telecommunication lines.	WAN covers a large distance geographical area that usually crosses regional or metropolitan boundaries and requires leased telecommunication lines.																		
Speed	LAN provides a comparatively higher speed.	WAN has a slower speed as compared to LAN.																		
Data Transfer Rate	LAN provides a high data transfer rate than WAN. It can reach up to 1000 Mbps.	WAN provides a relatively slower data transfer rate. It can reach up to 150mbps.																		
Ownership	LAN is owned, managed, and used by an individual or an organization. Therefore, it is a private network.	WAN can be either private or public. The Internet is the best example of public WAN.																		



Congestion	LAN has low congestion than WAN.	WAN has relatively higher congestion as compared to LAN.
Fault Tolerance	LAN has higher fault tolerance.	WAN has a lower fault tolerance as compared to LAN.
Technologies	LANs tend to use some particular connectivity technologies, mainly Ethernet and Token Ring.	WANs tend to use Frame Relay, MPLS, and ATM along with X.25 for connectivity over larger distances.
Connection	LANs can be attached over any distance using telephone lines and radio waves. Typically, co-axial or UTP cable is used as the transmission medium.	In WAN, the devices are connected through public networks, such as the telephone system. They can also be connected via leased lined or satellites.
Components	The main components of LAN include Layer 1 devices (e.g., hubs, repeaters) and Layer 2 devices (e.g., switches, bridges).	The main components of WAN include Layer 3 devices (e.g., Routers, Multi-layer switches) and technology-specific devices (e.g., AM, Frame-relay switches).
Bandwidth	LAN offers high bandwidth for the transmission.	WAN offers low bandwidth for the transmission.
Maintenance	Designing and maintenance of LANs are easy.	Designing and maintenance of WAN are complex.
Core Principle	It works on the principle of broadcasting.	It operates on the principle of point-to-point.
Cost	Since LAN covers a small area, it can be set up very cheaply.	The setup for WAN is high because of its wider geographical area.

b) Write steps to prepare crossover and straight cable using twisted pair cable.

6 M

Ans Straight cable

In this cable, wires are placed in the same position at both ends. The wire at pin 1 on one end of the cable connects to pin 1 at the other end of the cable. The wire at pin 2 connects to pin 2 on the other end of the cable; and so on.

The following table lists the wire positions of the straight-through cable on both sides.

steps to prepare crossover 3 M
steps to prepare straight cable 3 M



Side A	Side B
Green White	Green White
Green	Green
Orange White	Orange White
Blue	Blue
Blue White	Blue White
Orange	Orange
Brown White	Brown White
Brown	Brown

A straight-through cable is used to connect the following devices.

1. PC to Switch
2. PC to Hub
3. Router to Switch
4. Switch to Server
5. Hub to Server

cross-over cable

In this cable, transmitting pins of one side connect with the receiving pins of the other side.

The wire at pin 1 on one end of the cable connects to pin 3 at the other end of the cable. The wire at pin 2 connects to pin 6 on the other end of the cable. Remaining wires connect in the same positions at both ends.

The following table lists the wire positions of the cross-over cable on both side

Side A	Side B
Green White	Orange White
Green	Orange
Orange White	Green White
Blue	Blue
Blue White	Blue White
Orange	Green
Brown White	Brown White
Brown	Brown

The cross-over cable is used to connect the following devices.



1. Two computers
2. Two hubs
3. A hub to a switch
4. A cable modem to a router
5. Two router interfaces

c) Compare IPv4 and IPv6. (Any six point each)

6 M

Ans

Any six points 6 M

Basis for differences	IPv4	IPv6
Size of IP address	IPv4 is a 32-Bit IP Address.	IPv6 is 128 Bit IP Address.
Addressing method	IPv4 is a numeric address, and its binary bits are separated by a dot (.)	IPv6 is an alphanumeric address whose binary bits are separated by a colon (:). It also contains hexadecimal.
Number of header fields	12	8
Length of header filed	20	40
Checksum	Has checksum fields	Does not have checksum fields
Example	12.244.233.165	2001:0db8:0000:0000:0000:ff00:0042:7879
Type of Addresses	Unicast, broadcast, and multicast.	Unicast, multicast, and anycast.
Number of classes	IPv4 offers five different classes of IP Address. Class A to E.	IPv6 allows storing an unlimited number of IP Address.
VLSM support	IPv4 support VLSM (Variable Length Subnet mask).	IPv6 does not offer support for VLSM.
Network Configuration	Networks need to be configured either manually or with DHCP.	IPv6 support auto configuration capabilities.
SNMP	SNMP is a protocol used for system	SNMP does not support IPv6.



		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;"></td> <td style="width: 25%;">management.</td> <td style="width: 50%;"></td> </tr> <tr> <td>Packet size</td> <td>Packet size 576 bytes required, fragmentation optional</td> <td>1208 bytes required without fragmentation</td> </tr> </table>		management.		Packet size	Packet size 576 bytes required, fragmentation optional	1208 bytes required without fragmentation	
	management.								
Packet size	Packet size 576 bytes required, fragmentation optional	1208 bytes required without fragmentation							
6.		Attempt any <u>TWO</u> of the following:	12 M						
	a)	Calculate CRC for the frame 110101011 and generator Polynomial $X^4 + X + 1$ and write the transmitted frame.	6 M						
	Ans	<p> • Given frame for transmission is = 110101011 • Generator Polynomial is $x^4 + x + 1$ $= x^4 \cdot 1 + x^3 \cdot 0 + x^2 \cdot 0 + x^1 \cdot 1 + x^0 \cdot 1 = 10011$ • Append 4 zeros to the frame: 1101010110000 </p> <div style="text-align: center;"> $\begin{array}{r} 110000011 \\ 10011 \overline{) 1101010110000} \\ \underline{10011} \\ 00000 \\ \underline{00000} \\ 00001 \\ \underline{00000} \\ 00011 \\ \underline{00000} \\ 00110 \\ \underline{00000} \\ 01100 \\ \underline{00000} \\ 11000 \\ \underline{10011} \\ 10110 \\ \underline{10011} \\ 0101 \end{array}$ </div> <p>• Transmitted value is : <u>1101010110101</u></p>	<p>Identifying generator Polynomial = 1 M</p> <p>Calculating CRC for the frame 110101011 = 4 M</p> <p>Identifying the transmitted frame = 1 M</p>						
	b)	Compare OSI and TCP/IP network model (any six point each)	6 M						
	Ans		Any six points 6 M						



OSI Model	TCP/IP Model
OSI model provides a clear distinction between interfaces, services, and protocols.	TCP/IP doesn't have any clear distinguishing points between services, interfaces, and protocols.
OSI refers to Open Systems Interconnection.	TCP refers to Transmission Control Protocol.
OSI uses the network layer to define routing standards and protocols.	TCP/IP uses only the Internet layer.
OSI follows a vertical approach.	TCP/IP follows a horizontal approach.
OSI layers have seven layers.	TCP/IP has four layers.
In the OSI model, the transport layer is only connection-oriented.	A layer of the TCP/IP model is both connection-oriented and connectionless.
In the OSI model, the data link layer and physical are separate layers.	In TCP, physical and data link are both combined as a single host-to-network layer.
Session and presentation layers are a part of the OSI model.	There is no session and presentation layer in the TCP model.
The minimum size of the OSI header is 5 bytes.	The minimum header size is 20 bytes.

c)	Draw suitable network layout with star topology for a computer lab with 10 hosts and a wireless printers. List all components in the Layout.	6 M
----	---	------------

Ans	<p>Fig: layout with star topology for a computer lab with 10 hosts</p>	layout with star topology 4 M List all components in the layout 2 M
-----	--	--



Components required to design above layout:

Router/Switch

Laptop(10)/computers

Cat5/Cat6 cable

RJ45 connector