

**Max Marks: 50**

**Time: 3 Hrs.**

## **1. What is Open System Interconnection? CO1 K2 2**

The open systems interconnection (OSI) model is a conceptual model created by the International Organization for Standardization which enables diverse communication systems to communicate using standard protocols. In plain English, the OSI provides a standard for different computer systems to be able to communicate with each other.

The OSI Model can be seen as a universal language for computer networking. It's based on the concept of splitting up a communication system into seven abstract layers, each one stacked upon the last.

## **2. What is baud rate? CO2 K1 2**

The baud rate is the rate at which information is transferred in a communication channel. Baud rate is commonly used when discussing electronics that use serial communication. In the serial port context, "9600 baud" means that the serial port is capable of transferring a maximum of 9600 bits per second.

## **3. Define router. CO3 K4 2**

Routers are networking devices operating at layer 3 or a network layer of the OSI model. They are responsible for receiving, analysing, and forwarding data packets among the connected computer networks.

When a data packet arrives, the router inspects the destination address, consults its routing tables to decide the optimal route and then transfers the packet along this route.

## **4. Which transport layer feature is used to establish a connection-oriented session? CO4 K3 2**

**TCP**

In terms of the OSI model, **TCP** is a transport-layer protocol. It provides a connection-oriented data transmission service between applications, that is, a connection is established before data transmission begins.

## **5. Differentiate between POP3 and IMAP. CO5 K4 2**

**Differentiate between POP3 and IMAP.**

Parameter	POP3	IMAP
Full Form	POP3 is an abbreviation for Post Office Protocol 3.	IMAP is an abbreviation for Internet Message Access Protocol.

## ALL NOTE LINK

Introduc tion	The POP is an Internet standard protocol on the application layer that the local email clients use for retrieving emails from any remote server over the TCP/IP connection.	The IMAP is a protocol that allows distant users to access their emails directly from the server and read them on any device at any location feasible for them.
Comple xity	POP3 is a very simplified protocol. It can only download the emails on the local computer from the inbox.	The IMAP protocol is very complex. It allows all the users to view their email folders easily and read them on the mail server itself (from any device they want).
Email Organiz ation	A user cannot organize the emails on the server using POP3.	IMAP allows its users to organize their available emails on the server.
Need to Downlo ad	POP3 downloads the mail first and then allows its users to read them.	You can partially read your emails before downloading them in the case of IMAP.
Multiacc ess	POP3 only allows a single device at a time to access the emails.	IMAP allows multiple devices at a time to access and read the available mails.
Updatin g of Emails	A user cannot update or create emails on the mail server by using the POP3 protocol.	You can use the IMAP protocol for updating or creating emails. It is easy to do so with a web interface or email software.

## ALL NOTE LINK

Search Emails	You cannot search for mail content on any mail server using the POP3 protocol. The user needs to download the mail first and then search for the required content.	You can easily search for mail content on any mail server using IMAP without downloading them.
Change and Delete	POP3 does not allow its users to alter or delete any email available on the mail server.	IMAP allows its users to use an email software or a web interface to alter or delete the available emails.
Speed	POP3 is very fast.	IMAP is slow as compared to POP3.
Syncing of Mails	It does not allow syncing of a user's emails.	Users can sync their emails using this protocol.
Storage of Content	It downloads the content on the local device unless someone selects a "Keep a copy on the server" via settings.	It always stores content on the mail server.
Direction	<b>Unidirectional</b> – The changes that you make on a device have zero effect on the content available on the server.	<b>Bi-directional</b> – Whenever you make changes on the device or server, it shows on the other side as well.
Offline Usage	You can read the emails offline because POP3 downloads them on the device. The device only	The downloaded mails are available for the user to read, edit, and delete offline. Any changes that one makes on the device

## [ALL NOTE LINK](#)

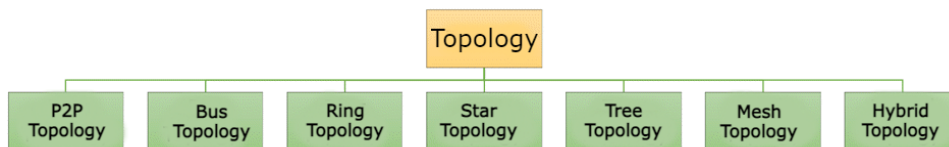
	goes online to download new emails.	get synced with the server.
Current Versions	POP3	IMAP4rev1

### SECTION-B(16 Marks)

#### 6. Define topology and mention the types of topologies. CO1 K3 5

Define topology and mention the types of topologies.

Network topologies describe the methods in which all the elements of a network are mapped. The topology term refers to both the physical and logical layout of a network.

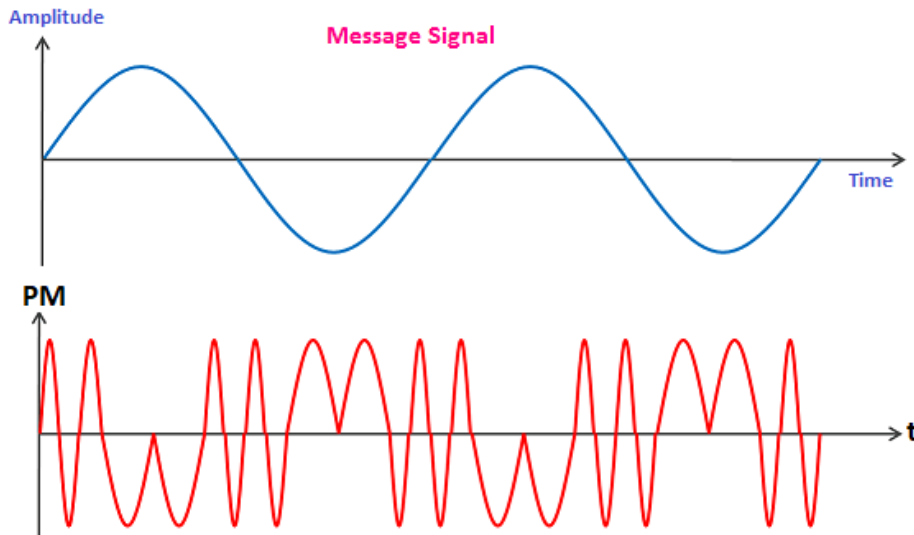


- **Bus Topology:** All the devices/nodes are connected sequentially to the same backbone or transmission line. This is a simple, low-cost topology, but its single point of failure presents a risk.
- **Star Topology:** All the nodes in the network are connected to a central device like a hub or switch via cables. Failure of individual nodes or cables does not necessarily create downtime in the network but the failure of a central device can. This topology is the most preferred and popular model.
- **Ring Topology:** All network devices are connected sequentially to a backbone as in bus topology except that the backbone ends at the starting node, forming a ring. Ring topology shares many of bus topology's disadvantages so its use is limited to networks that demand high throughput.
- **Tree Topology:** A root node is connected to two or more sub-level nodes, which themselves are connected hierarchically to sub-level nodes. Physically, the tree topology is similar to bus and star topologies; the network backbone may have a bus topology, while the low-level nodes connect using star topology.
- **Mesh Topology:** The topology in each node is directly connected to some or all the other nodes present in the network. This redundancy makes the network highly fault-tolerant but the escalated costs may limit this topology to highly critical networks.

### 7. Explain Phase Modulation technique using graphical representation. CO2 K4 5

Explain Phase Modulation technique using graphical representation.

Phase modulation is defined as the process of varying the phase of the carrier signal linearly with the instantaneous value of the message signal. The waveforms of a message signal and the phase-modulated signal are shown below:



The equation of a PM signal is represented by:

$$V(t) = A \cos [\omega_c t + \phi(t)]$$

Where,

$\omega_c$  is the carrier frequency constant

A is the amplitude constant

$\phi(t)$  is the phase angle, which is not constant. It is a function of the baseband signal.

Let's first discuss the message signal and the carrier signal.

The applications of Phase Modulation are listed as follows:

- **SoundSynthesis**

PM is less susceptible to noise interference and popping sounds than AM. Hence, it is suitable for sound broadcasting, commonly referred to as sound synthesis.

- **Digital Synthesizers**

PM is used in digital synthesizers for the generation of signals and waveform.

- **Telephone Communication**

PM is widely used in telephone communication due to its high-speed transmission.

The advantages of Phase Modulation are as follows:

- **High speed**

Phase modulation is considered as one of the fastest modulation techniques. It is due to the pulse generation at high speed.

- **Low signal power consumption**

PM requires low signal power consumption due to its better efficiency and fast speed.

- **Simple circuit design**

The components required in the phase modulated circuit are less as compared to FM. Hence, it has a simple circuit design.

- **Easy modulation and demodulation**

Phase modulation and demodulation is easy as compared to PM due to its simple circuit design.

**8. Illustrate the use of Hamming Code for Error detection and correction? CO6 K6 6**  
**SECTION-C (24 Marks) 8 Marks each**

27

Define Hamming Code? What is the 7 bit Hamming code for 1101?

8

**Hamming code** is a set of error-correction codes that can be used to **detect and correct the errors** that can occur when the data is moved or stored from the sender to the receiver. It is a **technique developed by R.W. Hamming for error correction**. **Redundant bits** – Redundant bits are extra binary bits that are generated and added to the information-carrying bits of data transfer to ensure that no bits were lost during the data transfer. The number of redundant bits can be calculated using the following formula:

$$2^r \geq m + r + 1$$

where,  $r$  = redundant bit,  $m$  = data bit

**Hamming (7, 4) code:** It is a linear error-correcting code that encodes four bits of data into seven bits, by adding three parity bits.

**Example:** It is used in the Bell-Telephone laboratory, error-prone punch card reader to detect the error and correct them.

Hamming code:

Bits #	1	2	3	4	5	6	7
Transmitted bits	$P_1$	$P_2$	$d_1$	$P_3$	$d_2$	$d_3$	$d_4$

$P_1 = d_1 \oplus d_2 \oplus d_4$

$P_2 = d_1 \oplus d_4 \oplus d_3$

$P_3 = d_2 \oplus d_4 \oplus d_3$

Solution:

Given data 1101 i.e.

$d_1 = 1, d_2 = 1, d_3 = 0, d_4 = 1$

We can write:

$P_1 = d_1 \oplus d_2 \oplus d_4 = 1 \oplus 1 \oplus 1 = 1$

$$P_2 = d_1 \oplus d_4 \oplus d_3 = 1 \oplus 1 \oplus 0 = 0$$

$$P_3 = d_2 \oplus d_4 \oplus d_3 = 1 \oplus 1 \oplus 0 = 0$$

Then transmitted final code is

$P_1$	$P_2$	$d_1$	$P_3$	$d_2$	$d_3$	$d_4$
1	0	1	0	1	0	1

i.e. 1010101

Option 3 correct

**8. Discuss about a) GO BACK N ARQ and b) Selective repeat ARQ. CO3 K4 8**

9. 22	<p>Discuss about a) GO BACK N ARQ and b) Selective repeat ARQ.</p> <table border="0"> <thead> <tr> <th>S.N</th> <th>Go-Back-N Protocol</th> <th>Selective Repeat Protocol</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>In Go-Back-N Protocol, if the sent frame are found suspected then all the frames are re-transmitted from the lost packet to the last packet transmitted.</td> <td>In selective Repeat protocol, only those frames are re-transmitted which are found suspected.</td> </tr> <tr> <td>2.</td> <td>Sender window size of Go-Back-N Protocol is N.</td> <td>Sender window size of selective Repeat protocol is also N.</td> </tr> <tr> <td>3.</td> <td>Receiver window size of Go-Back-N Protocol is 1.</td> <td>Receiver window size of selective Repeat protocol is N.</td> </tr> <tr> <td>4.</td> <td>Go-Back-N Protocol is less complex.</td> <td>Selective Repeat protocol is more complex.</td> </tr> <tr> <td>5.</td> <td>In Go-Back-N Protocol, neither sender nor at receiver need sorting.</td> <td>In selective Repeat protocol, receiver side needs sorting to sort the frames.</td> </tr> <tr> <td>6.</td> <td>In Go-Back-N Protocol, type of Acknowledgement is cumulative.</td> <td>In selective Repeat protocol, type of Acknowledgement is</td> </tr> </tbody> </table>	S.N	Go-Back-N Protocol	Selective Repeat Protocol	1.	In Go-Back-N Protocol, if the sent frame are found suspected then all the frames are re-transmitted from the lost packet to the last packet transmitted.	In selective Repeat protocol, only those frames are re-transmitted which are found suspected.	2.	Sender window size of Go-Back-N Protocol is N.	Sender window size of selective Repeat protocol is also N.	3.	Receiver window size of Go-Back-N Protocol is 1.	Receiver window size of selective Repeat protocol is N.	4.	Go-Back-N Protocol is less complex.	Selective Repeat protocol is more complex.	5.	In Go-Back-N Protocol, neither sender nor at receiver need sorting.	In selective Repeat protocol, receiver side needs sorting to sort the frames.	6.	In Go-Back-N Protocol, type of Acknowledgement is cumulative.	In selective Repeat protocol, type of Acknowledgement is	8
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## ALL NOTE LINK

		individual.	
	7. In Go-Back-N Protocol, Out-of-Order packets are NOT Accepted (discarded) and the entire window is re-transmitted.	In selective Repeat protocol, Out-of-Order packets are Accepted. In selective Repeat protocol, if Receives a corrupt packet, it immediately sends a negative	
	8. In Go-Back-N Protocol, if Receives a corrupt packet, then also, the entire window is re-transmitted. Efficiency of Go-Back-N Protocol is	acknowledgement and hence only the selective packet is retransmitted. Efficiency of selective Repeat protocol is also	
	9. $N/(1+2*a)$	$N/(1+2*a)$	

**10. What is cryptography? Distinguish between symmetric and asymmetric key cryptography.**

**CO4 K5 8**

Cryptography is technique of securing information and communications through use of codes so that only those person for whom the information is intended can understand it and process it. Thus preventing unauthorized access to information. The prefix "crypt" means "hidden" and suffix graphy means "writing".

### **Symmetric Key Encryption**

It only requires a single key for both encryption and decryption.

The size of cipher text is the same or smaller than the original plain text.

The encryption process is very fast.

It is used when a large amount of data is required to transfer.

### **Asymmetric Key Encryption**

It requires two keys, a public key and a private key, one to encrypt and the other one to decrypt.

The size of cipher text is the same or larger than the original plain text.

The encryption process is slow.

It is used to transfer small amounts of data.

## Symmetric Key Encryption

It only provides confidentiality.

The length of key used is 128 or 256 bits

In symmetric key encryption, resource utilization is low as compared to asymmetric key encryption.

It is efficient as it is used for handling large amount of data.

Security is less as only one key is used for both encryption and decryption purpose.

The Mathematical Representation is as follows-  
 $P = D(K, E(P))$

where  $K \rightarrow$  encryption and decryption key

$P \rightarrow$  plain text

$D \rightarrow$  Decryption

$E(P) \rightarrow$  Encryption of plain text

## Asymmetric Key Encryption

It provides confidentiality, authenticity, and non-repudiation.

The length of key used is 2048 or higher

In asymmetric key encryption, resource utilization is high.

It is comparatively less efficient as it can handle a small amount of data.

It is more secure as two keys are used here- one for encryption and the other for decryption.

The Mathematical Representation is as follows-

$P = D(K_d, E(K_e, P))$

where  $K_e \rightarrow$  encryption key

$K_d \rightarrow$  decryption key

$D \rightarrow$  Decryption

$E(K_e, P) \rightarrow$  Encryption of plain text using encryption key  $K_e$ .  $P \rightarrow$  plain text

### 1. Define signals. CO1 K2 2

A signal is an electrical or electromagnetic current that is used for carrying data from one device or network to another.

### 2. Which is faster between digital and analog data transmission? CO2 K1 2

digital

### 3. Define ARQ. CO3 K4 2

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**ARQ** stands for **Automatic Repeat Request** also known as **Automatic Repeat Query**. ARQ is an error-control strategy used in a two-way communication system

#### 4. What allows TCP to detect lost segments? CO4 K3 2

**Acknowledgment number** Best explanation: TCP header contains separate fields for sequence number and acknowledgment number.

Comparing these values is what allows TCP to detect lost segments and in turn recover from that loss. After detecting the lost segments, the recovery may require retransmission of the lost segments of data. Read more on Sarthaks.com - <https://www.sarthaks.com/2447165/what-allows-tcp-to-detect-lost-segments-and-in-turn-recover-from-that-loss>

#### 5. Explain the term WWW. CO5 K4 2

##### **What Does World Wide Web (WWW) Mean?**

The World Wide Web (WWW) is a network of online content that is formatted in HTML and accessed via HTTP. The term refers to all the interlinked HTML pages that can be accessed over the Internet. The World Wide Web was originally designed in 1991 by Tim Berners-Lee while he was a contractor at CERN.

The World Wide Web is most often referred to simply as "the Web."

##### **Techopedia Explains World Wide Web (WWW)**

The World Wide Web is what most people think of as the Internet. It is all the Web pages, pictures, videos and other online content that can be accessed via a Web browser. The Internet, in contrast, is the underlying network connection that allows us to send email and access the World Wide Web.

#### SECTION-B(16 Marks)

#### 6. Differentiate between propagation delay and transmission delay. CO1 K3 5

**The propagation delay is the time it takes for one bit to travel from one end of the link to the other.** The bits travel in the form of [electromagnetic signals](#). The speed at which electromagnetic signals propagate is determined by the medium through which they pass. Following is the formula for propagation delay:

$D/s$

where  $D$  is the distance between sender and receiver over a link, and  $S$  is the transmission speed.

For example, if the distance between the two points is  $48,000\text{ km}$  and the propagation speed is  $2.4 \times 10^8 \frac{\text{m}}{\text{s}}$  in a cable then the propagation delay will be:

$$\frac{48000 \times 10^3}{2.4 \times 10^8} = 200\text{ms}$$

**Transmission delay is the time needed to push all the packet bits on the transmission link.** It mainly depends upon the size of the data and channel [bandwidth](#) (in bps). Following is the formula for transmission delay:

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$$\frac{L}{R}$$

where  $L$  is the length of the packet and  $R$  is the transmission rate.

For example, the transmission of 1500bytes (12000bits) using a transmission rate of 100Mbps will take:

$$t = \frac{12000}{100 \times 10^6} = 0.12ms$$

## 7. Explain the terms Line Coding, Block Coding and Scrambling. CO2 K4 5

Explain the terms Line Coding, Block Coding and Scrambling.

Conversion of Digital Data to Digital Signal involves three techniques:

1. [Line Coding](#)
2. Block Coding
3. Scrambling

**Block coding** helps in error detection and re-transmission of the signal. It is normally referred to as mB/nB coding as it replaces each m-bit data group with an n-bit data group (where  $n > m$ ). Thus, it adds extra bits (redundancy bits) which helps in synchronization at receiver's and sender's end and also providing some kind of error detecting capability.

In telecommunication, a line code (also called digital baseband modulation, also called digital baseband transmission method) is a code chosen for use within a communications system for baseband transmission purposes. Line coding is often used for digital data transport.

**Scrambling** is a technique that does not increase the number of bits and does provide synchronization. The problem with techniques like Bipolar AMI (Alternate Mark Inversion) is that continuous sequence of zero's create synchronization problems one solution to this is Scrambling.

## 8. Compare FTP and SSH. CO6 K6 6

Compare FTP and SSH.

S. N o.	FTP	SSH
	It offers communication that is distance-dependent.	Its communication does not depend on distance.
1.		
	It is less secure and not suited in critical situations.	It offers secure communication.
2.		

3.	It cannot be used in case of tunneling.	In a situation like tunneling, we can use SSH.
4.	It offers few features and options during communication.	It has more features than FTP.
5.	It provides fewer functionalities than SSH.	It offers more functionalities than FTP.
6.	For communication, it runs on port number 21.	It runs on port number 22.
7.	In this, Data encryption is not there.	It provides data encryption.
8.	It is a protocol that is used for transferring files from a local client to a remote server.	While SSH is used for the communication between two computers that are connected by some electrical medium.
9.	FTP is generally faster.	While SSH is generally slower as compared to FTP.

## SECTION-C (24 Marks) 8 Marks each

### 10. Explain the protocols in Data link layer. CO3 K4 8

26	<p>Explain the protocols in Data link layer .</p> <div><div>Data Link Protocols</div><ul style="list-style-type: none"><li>SDLC (Synchronous Data Link Protocol)</li><li>HDLC (High-Level Data Link Control)</li><li>SLIP (Serial Line Interface Protocol)</li><li>PPP (Point-to-Point Protocol)</li><li>LCP (Link Control Protocol)</li><li>LAP (Link Access Procedure)</li><li>NCP (Network Control Protocol)</li></ul><p>1. <a href="#">Synchronous Data Link Protocol (SDLC)</a> – SDLC is basically a communication protocol of computer. It usually supports multipoint links even</p></div>	8
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## ALL NOTE LINK

error recovery or error correction also. It is usually used to carry SNA (Systems Network Architecture) traffic and is present precursor to HDLC. It is also designed and developed by IBM in 1975. It is also used to connect all of the remote devices to mainframe computers at central locations may be in point-to-point (one-to-one) or point-to-multipoint (one-to-many) connections. It is also used to make sure that the data units should arrive correctly and with right flow from one network point to next network point.

2. [High-Level Data Link Protocol \(HDLC\)](#) –

HDLC is basically a protocol that is now assumed to be an umbrella under which many Wide Area protocols sit. It is also adopted as a part of X.25 network. It was originally created and developed by ISO in 1979. This protocol is generally based on SDLC. It also provides best-effort unreliable service and also reliable service. HDLC is a bit-oriented protocol that is applicable for point-to-point and multipoint communications both.

3. [Serial Line Interface Protocol \(SLIP\)](#) –

SLIP is generally an older protocol that is just used to add a framing byte at end of IP packet. It is basically a data link control facility that is required for transferring IP packets usually among Internet Service Providers (ISP) and a home user over a dial-up link. It is an encapsulation of the TCP/IP especially designed to work with over serial ports and several router connections simply for communication. It is some limitations like it does not provide mechanisms such as error correction or error detection.

4. [Point to Point Protocol \(PPP\)](#) –

PPP is a protocol that is basically used to provide same functionality as SLIP. It is most robust protocol that is used to transport other types of packets also along with IP Packets. It can also be required for dial-up and leased router-router lines. It basically

provides framing method to describe frames. It is a character-oriented protocol that is also used for error detection. It is also used to provides two protocols i.e. NCP and LCP. LCP is used for bringing lines up, negotiation of options, bringing them down whereas NCP is used for negotiating network-layer protocols. It is required for same serial interfaces like that of HDLC.

### **5. Link Control Protocol (LCP) –**

It was originally developed and created by IEEE 802.2. It is also used to provide HDLC style services on LAN (Local Area Network). LCP is basically a PPP protocol that is used for establishing, configuring, testing, maintenance, and ending or terminating links for transmission of data frames.

### **6. Link Access Procedure (LAP) –**

LAP protocols are basically a data link layer protocols that are required for framing and transferring data across point-to-point links. It also includes some reliability service features. There are basically three types of LAP i.e. LAPB (Link Access Procedure Balanced), LAPD (Link Access Procedure D-Channel), and LAPF (Link Access Procedure Frame-Mode Bearer Services). It is actually originated from IBM SDLC, which is being submitted by IBM to the ISP simply for standardization.

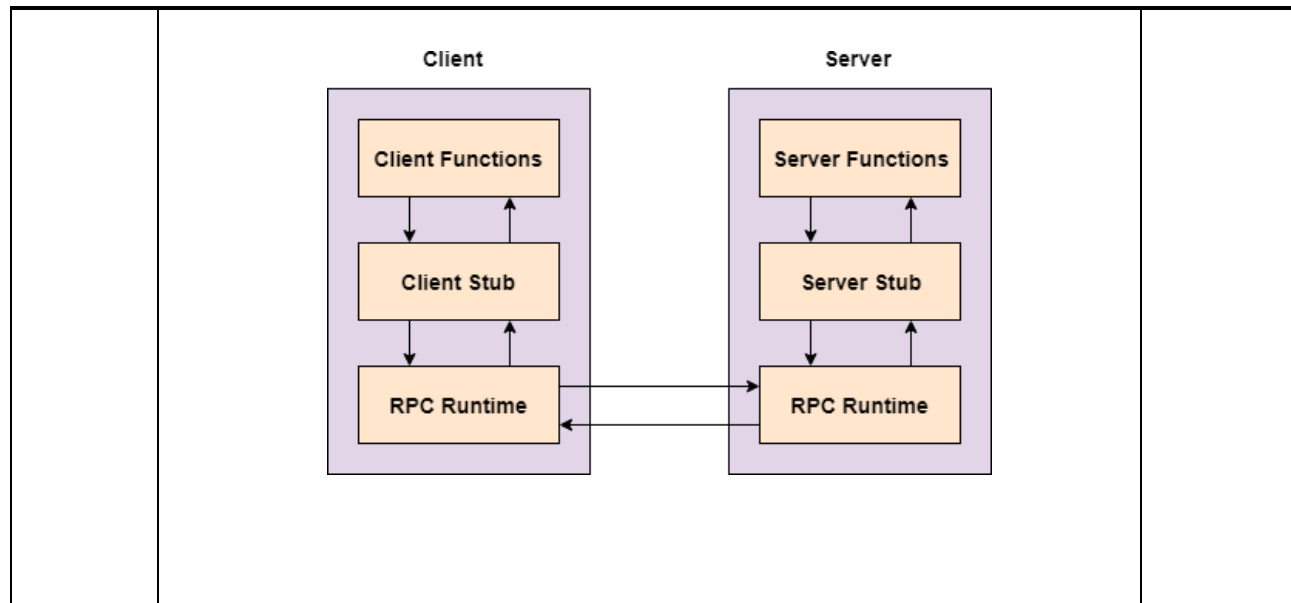
### **7. Network Control Protocol (NCP) –**

NCP was also an older protocol that was implemented by ARPANET. It basically allows users to have access to use computers and some of the devices at remote locations and also to transfer files among two or more computers. It is generally a set of protocols that is forming a part of PPP. NCP is always available for each and every higher-layer protocol that is supported by PPP. NCP was replaced by TCP/IP in the 1980s.



**11. Explain the concept of Remote Procedure Calls in computer networks. CO4 K5 8**

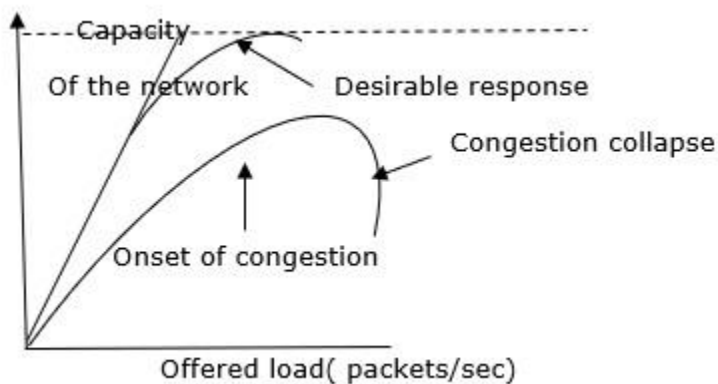
<b>27</b>	<p><b>Explain the concept of Remote Procedure Calls in computer networks.</b></p> <p>A remote procedure call is an interprocess communication technique that is used for client-server based applications. It is also known as a subroutine call or a function call.</p> <p>A client has a request message that the RPC translates and sends to the server. This request may be a procedure or a function call to a remote server. When the server receives the request, it sends the required response back to the client. The client is blocked while the server is processing the call and only resumed execution after the server is finished.</p> <p>The sequence of events in a remote procedure call are given as follows –</p> <ul style="list-style-type: none"><li>• The client stub is called by the client.</li><li>• The client stub makes a system call to send the message to the server and puts the parameters in the message.</li><li>• The message is sent from the client to the server by the client's operating system.</li><li>• The message is passed to the server stub by the server operating system.</li><li>• The parameters are removed from the message by the server stub.</li><li>• Then, the server procedure is called by the server stub.</li></ul> <p>A diagram that demonstrates this is as follows –</p>	<b>8</b>
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## 11. How do you implement a leaky bucket algorithm for congestion control? Illustrate with an example.

When too many packets are present in the network it causes packet delay and loss of packet which degrades the performance of the system. This situation is called congestion.

The network layer and transport layer share the responsibility for handling congestions. One of the most effective ways to control congestion is trying to reduce the load that transport layer is placing on the network. To maintain this, the network and transport layers have to work together.



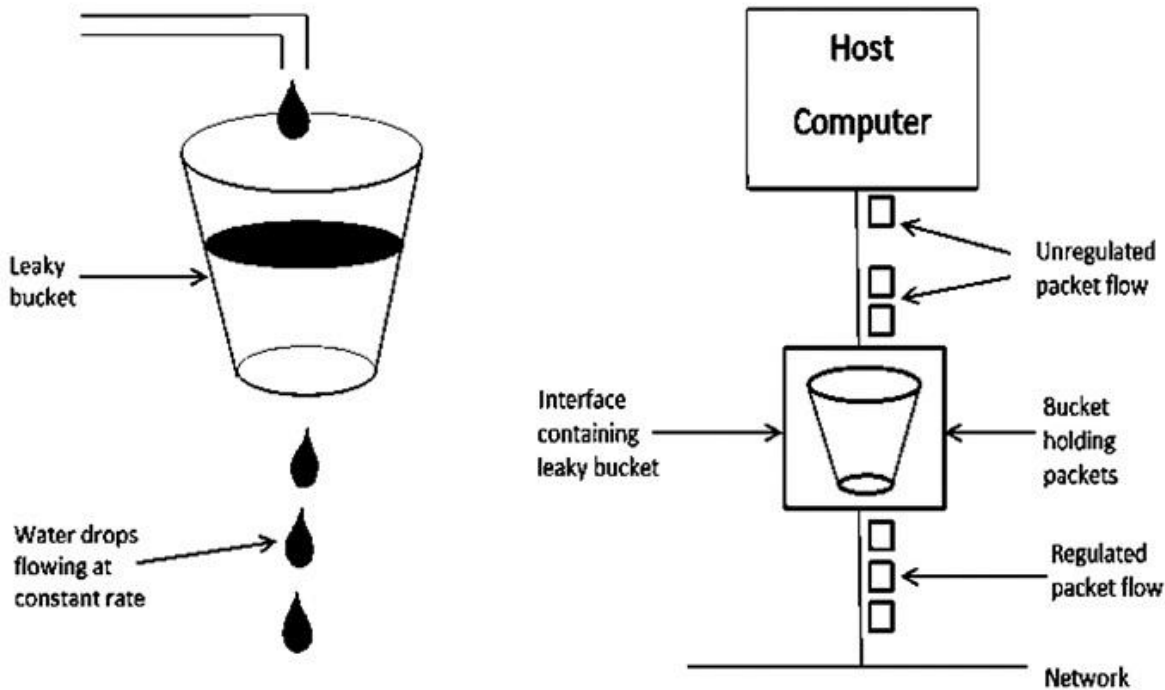
With too much traffic, performance drops sharply.

There are two types of Congestion control algorithms, which are as follows –

- Leaky Bucket Algorithm
- Token Bucket Algorithm

## **Leaky Bucket Algorithm**

Let see the working condition of Leaky Bucket Algorithm –



Leaky Bucket Algorithm mainly controls the total amount and the rate of the traffic sent to the network.

**Step 1** – Let us imagine a bucket with a small hole at the bottom where the rate at which water is poured into the bucket is not constant and can vary but it leaks from the bucket at a constant rate.

**Step 2** – So (up to water is present in the bucket), the rate at which the water leaks does not depend on the rate at which the water is input to the bucket.

**Step 3** – If the bucket is full, additional water that enters into the bucket that spills over the sides and is lost.

**Step 4** – Thus the same concept applied to packets in the network. Consider that data is coming from the source at variable speeds. Suppose that a source sends data at 10 Mbps for 4 seconds. Then there is no data for 3 seconds. The source again transmits data at a rate of 8 Mbps for 2 seconds. Thus, in a time span of 8 seconds, 68 Mb data has been transmitted.

That's why if a leaky bucket algorithm is used, the data flow would be 8 Mbps for 9 seconds. Thus, the constant flow is maintained.

## 1. Define switching. CO1 K2 2

Switching, as applied to networking and IT, is the practice of directing a signal or data element toward a particular hardware destination. Switching may be applied in various formats and can function in diverse ways within a greater network infrastructure.

## 2. What is the best modulation technique? CO2 K1 2

**Frequency modulation** is more effective in terms of noise tolerance and more suited for data transmission than AM. Phase modulation is more complex and costly but is relatively immune to noise and theoretically makes the best use of bandwidth for a given transmission rate.

## 3. What is more difficult among error detection and error correction? Explain. CO3 K4 2

- **Error detection** is a method that can look at some data and detect if it has been corrupted while it was stored or transmitted.
- **Error correction** is a step better than error detection; when it detects an error it tries to put the data back to how it should have been.

## 4. What are the responsibilities of network layer? CO4 K3 2

**Network layer** is the third layer in the [OSI model](#) of computer networks. **It's main function is to transfer network packets from the source to the destination.** It is involved both at the source host and the destination host. At the source, it accepts a packet from the transport layer, encapsulates it in a datagram and then deliver the packet to the data link layer so that it can further be sent to the receiver. At the destination, the datagram is decapsulated, the packet is extracted and delivered to the corresponding transport layer.

## 5. List the request methods used by HTTP. CO5 K4 2

**HTTP (Hypertext Transfer Protocol)** specifies a collection of request methods to specify what action is to be performed on a particular resource. The most commonly used HTTP request methods are **GET, POST, PUT, PATCH, and DELETE**. These are equivalent to the **CRUD operations (create, read, update, and delete)**.

**GET:** GET request is used to read/retrieve data from a web server. GET returns an HTTP status code of **200 (OK)** if the data is successfully retrieved from the server.

**POST:** POST request is used to send data (file, form data, etc.) to the server. On successful creation, it returns an HTTP status code of **201**.

**PUT:** A PUT request is used to modify the data on the server. It replaces the entire content at a particular location with data that is passed in the body payload. If there are no resources that match the request, it will generate one.

**PATCH:** PATCH is similar to PUT request, but the only difference is, it modifies a part of the data. It will only replace the content that you want to update.

**DELETE:** A DELETE request is used to delete the data on the server at a specified location.

**SECTION-B(16 Marks)****6. Differentiate between Analog and Digital signals. CO1 K3 5**

Difference Between Analog And Digital Signal	
Analog Signals	Digital Signals
Continuous signals	Discrete signals
Represented by sine waves	Represented by square waves
Human voice, natural sound, analog electronic devices are a few examples	Computers, optical drives, and other electronic devices
Continuous range of values	Discontinuous values
Records sound waves as they are	Converts into a binary waveform
Only used in analog devices	Suited for digital electronics like computers, mobiles and more

**7. Explain Delta Modulation. CO2 K4 5****Delta Modulation**

The type of modulation, where the sampling rate is much higher and in which the stepsize after quantization is of a smaller value  $\Delta$ , such a modulation is termed as **delta modulation**.

---

## Features of Delta Modulation

Following are some of the features of delta modulation.

- An over-sampled input is taken to make full use of the signal correlation.
- The quantization design is simple.
- The input sequence is much higher than the Nyquist rate.
- The quality is moderate.
- The design of the modulator and the demodulator is simple.
- The stair-case approximation of output waveform.
- The step-size is very small, i.e.,  $\Delta$ .
- The bit rate can be decided by the user.
- This involves simpler implementation.

Delta Modulation is a simplified form of DPCM technique, also viewed as **1-bit DPCM scheme**. As the sampling interval is reduced, the signal correlation will be higher.

## 8. Explain various IEEE standards for LAN protocols. CO6 K6 6

IEEE standards in computer networks	Description
IEEE 802	It is used for the overview and architecture of LAN/MAN.
IEEE 802.1	It is used for bridging and management of LAN/MAN.
IEEE 802.1s	It is used in multiple spanning trees.
IEEE 802.1w	It is used for rapid reconfiguration of spanning trees.
IEEE 802.1x	It is used for network access control of ports.
IEEE 802.2	It is used in Logical Link Control (LLC).
IEEE 802.3	It is used in Ethernet (CSMA/CD access method).
IEEE 802.3ae	It is used for 10 Gigabit Ethernet.
IEEE 802.4	It is used for token passing bus access methods and the physical layer specifications.
IEEE 802.5	It is used for token ring access methods and the physical layer specifications.
IEEE 802.6	It is used in distributed Queue Dual Bus (DQDB) access method and for the physical layer specifications (MAN).
IEEE 802.7	It is used in broadband LAN.
IEEE 802.8	It is used in fiber optics.
IEEE 802.9	It is used in isochronous LANs.
IEEE 802.10	It is used in interoperable LAN/MAN security.
IEEE 802.11	It is used in wireless LAN, MAC, and Physical layer specifications.
IEEE 802.12	It is used in the demand-priority access method, in the physical layer, and in repeater specifications.
IEEE 802.13	It is not used.

**IEEE standards in computer networks**

**Description**

IEEE 802.14	It is used in cable modems (not used now).
IEEE 802.15	It is used in WPAN (Wireless Personal Area Network).
IEEE 802.16	It is used in Wireless MAN (Wireless Metropolitan Area Network).
IEEE 802.17	It is used in RPR access (Resilient Packet Ring).

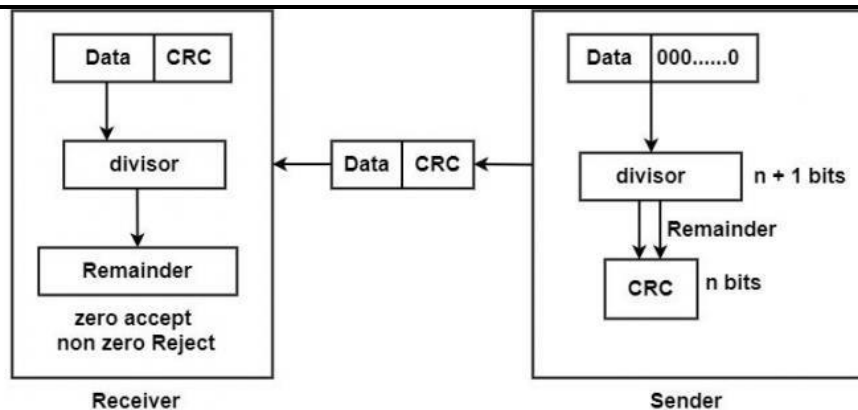
**SECTION-C (24 Marks) 8 Marks each**

9.

**Calculate the Cyclic Redundancy Code(CRC) for data word: 110010101 with Generator = 10101.**

**CO3 K4 8**

21	<p><b>Explain how errors are detected using CRC.</b></p> <p>The Cyclic Redundancy Checks (CRC) is the most powerful method for Error-Detection and Correction. It is given as a kbit message and the transmitter creates an (n – k) bit sequence called frame check sequence. The out coming frame, including n bits, is precisely divisible by some fixed number. Modulo 2 Arithmetic is used in this binary addition with no carries, just like the XOR operation.</p> <p>Redundancy means <b>duplicacy</b>. The redundancy bits used by CRC are changed by splitting the data unit by a fixed divisor. The remainder is CRC.</p> <p><b>Qualities of CRC</b></p> <ul style="list-style-type: none"><li>• It should have accurately one less bit than the divisor.</li><li>• Joining it to the end of the data unit should create the resulting bit sequence precisely divisible by the divisor.</li></ul> <p><b>CRC generator and checker</b></p>	8
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## Process

- A string of  $n$  0s is added to the data unit. The number  $n$  is one smaller than the number of bits in the fixed divisor.
- The new data unit is divided by a divisor utilizing a procedure known as binary division; the remainder appearing from the division is CRC.
- The CRC of  $n$  bits interpreted in phase 2 restores the added 0s at the end of the data unit

## Example

Message D = 1010001101 (10 bits)

Predetermined P = 110101 (6 bits)

FCS R = to be calculated 5 bits

Hence,  $n = 15$   $K = 10$  and  $(n - k) = 5$

The message is generated through  $2^5$ :accommodating 1010001101000

The product is divided by P.

```

      1101010110 ← Q
110101 ) 10100011010000
        110101
        111011
        110101
        111010
        110101
        111110
        110101
        101100
        110101
        110010
        110101
        01110 ← R
```



The remainder is inserted to  $2^5D$  to provide  $T = 101000110101110$  that is sent.

Suppose that there are no errors, and the receiver gets  $T$  perfect. The received frame is divided by  $P$ .

$$\begin{array}{r} 1101010110 \\ 110101 \overline{) 101000110101110} \\ \underline{110101} \phantom{000000000000} \\ 1110111 \phantom{00000000000} \\ \underline{1101101} \phantom{00000000000} \\ 111010 \phantom{00000000000} \\ \underline{110101} \phantom{00000000000} \\ 111110 \phantom{00000000000} \\ \underline{110101} \phantom{00000000000} \\ 101100 \phantom{00000000000} \\ \underline{110101} \phantom{00000000000} \\ 110101 \phantom{00000000000} \\ \underline{110101} \phantom{00000000000} \\ 0 \leftarrow R \end{array}$$

Because of no remainder, there are no errors.

#### 10. Discuss TCP-Window Management System? CO4 K5 8

Window management in TCP is an important concept that ensures reliability in packet delivery as well as reduce the wastage of time in waiting for the acknowledge after each packet.

**Window size:** window size determines the amount of data that you can transmit before receiving an acknowledgment. Sliding window refers to the fact that the window size is negotiated dynamically during the TCP session.

1. Expectational acknowledgment means that the acknowledgment number refers to the octet that is next expected
2. If the source receives no acknowledgment, it knows to retransmit at a slower rate.
3. The mechanism of the sliding window style may be understood easily with the help of below given
4. diagrams:

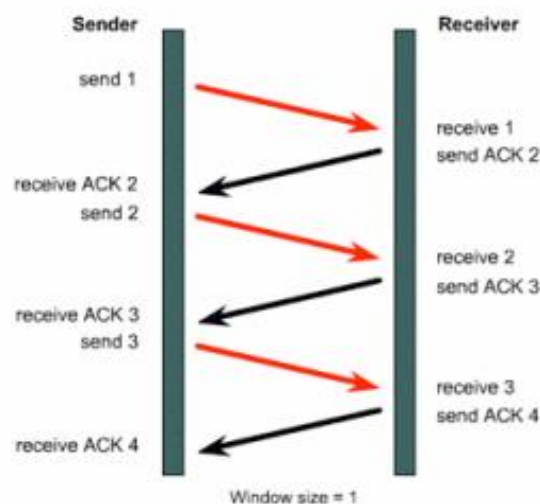


Figure one

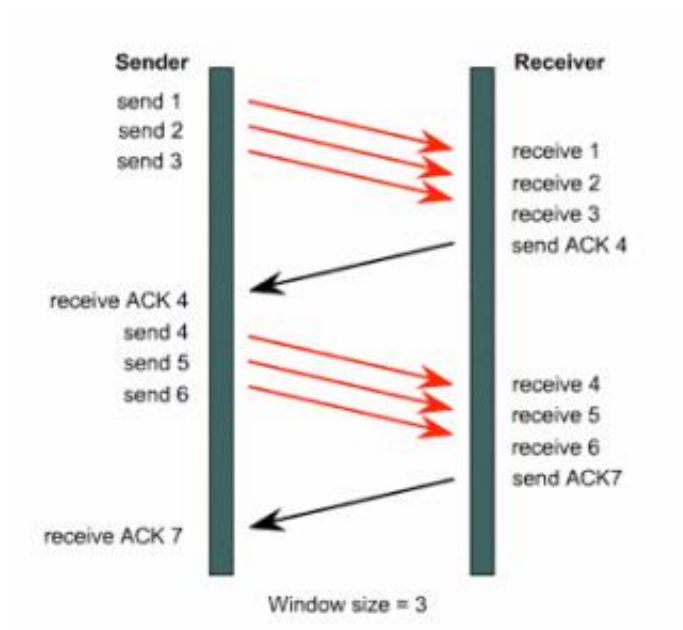
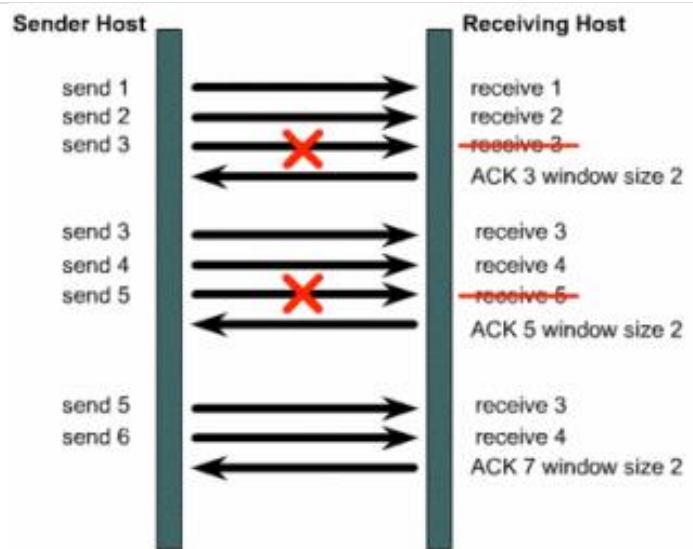


figure two



6.

### **12. Describe the three protocols used to deliver email over the Internet. CO5 K5 8**

Describe the three protocols used to deliver email over the Internet.

#### **What is an email protocol?**

Email protocol is a set of rules defined to ensure that emails can be exchanged between various servers and email clients in a standard manner. This ensures that the email is universal and works for all users.

Example:

A sender using an Apple email client with a Gmail server can send an email to another user using a Zoho mail server on an Outlook email client. This is possible because the servers and the email clients follow the rules and standards defined by the email protocols.

#### **Why do we need email protocols?**

Consider the difference between sending a message via a messaging platform like WhatsApp and sending an email. When you send a message using WhatsApp, the recipient will also use WhatsApp to read the messages. The server which processes the message is also the WhatsApp server. The same platform is used in the server and the client, and hence the entire flow of data is handled by the serving platform in a custom manner.

In the case of email, the sender, recipients, and servers involved can all be different but then they need to receive the data, decipher the content and render it in the same way the sender has sent it. Email protocols define how the email message has to be encoded, how it needs to be sent, received, rendered, and so on, and hence they are essential. While email protocols make the process behind emails a bit complex, the protocols ensure that email is a standard, reliable, and universal mode of communication.

#### **What are the different email protocols?**

The common protocols for email delivery are Post Office Protocol (POP), Internet Message Access Protocol (IMAP), and Simple Mail Transfer Protocol (SMTP). Each of these protocols has a standard methodology to deal with the emails and also has defined functions.

#### **POP Protocol**

POP stands for Post Office Protocol. Email clients use the POP protocol support in the server to download the emails. This is primarily a one-way protocol and does not sync back the emails to the server.

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## IMAP Protocol

IMAP stands for Internet Message Access Protocol. IMAP Protocol is used to sync the emails in the server with the email clients. It allows two-way sync of emails between the server and the email client, while the emails are stored on the server.

## SMTP Protocol

SMTP stands for Simple Mail Transfer Protocol. SMTP is the principal email protocol that is responsible for the transfer of emails between email clients and email servers.

