

## Assignment : UNIT-5

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Ques 1)

Ans -

Explain analog and digital transmission

Analog Transmission -

To send the digital data over on analog media, it needs to be converted into analog signal. There can be two causes according to data formatting.

Bandpass -

The filters are used to filter and pass frequencies of interest. A bandpass is a band of frequencies which can pass the filter.

Lowpass -

Lowpass is a filter that passes low frequencies signals.

When digital data is converted into a bandpass analog signal, it called digital to analog conversion. When low pass analog signal is converted into bandpass Analog Signal, it is called analog to analog conversion.

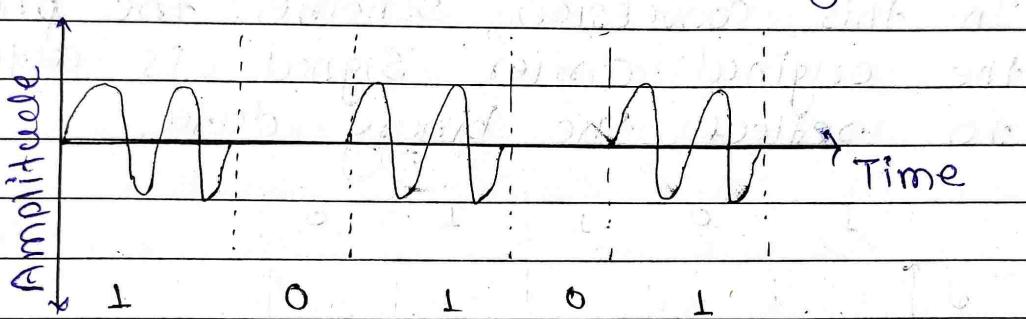
\* Digital to Analog conversion -

When data from one computer is sent to another via same analog carrier, it is first converted into analog signals. Analog signals are modified to select digital data.

An analog signal is characterized by its amplitude, frequency and phase. There are three kinds of frequency and phase signals used in analog conversion.

1) Amplitude shift keying -

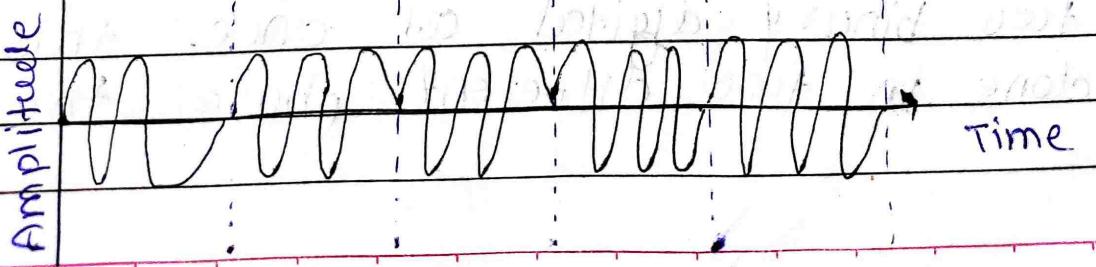
In this conversion technique, the amplitude of analog carrier signal is modified to reflect binary data.



When binary data represent digit 1, the amplitude is held, otherwise it is set to 0. Both frequency and phase remain the same as in the original carrier signal. It is digital data transmission.

2) Frequency shift keying -

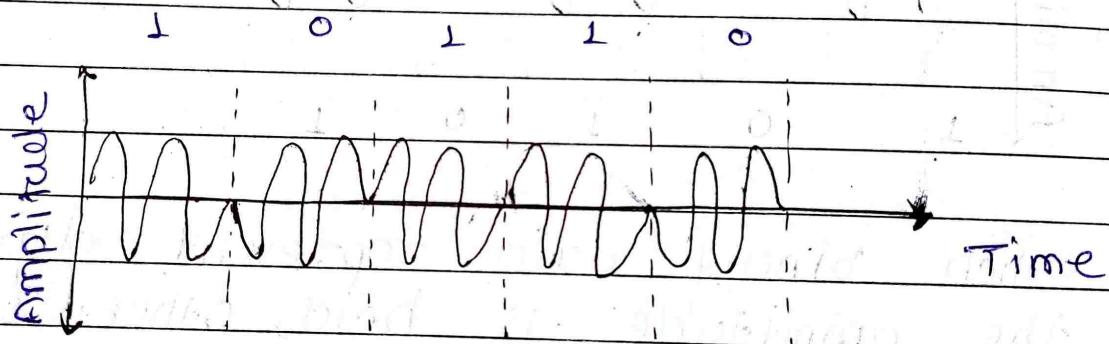
In this conversion technique, the frequency of the analogue carrier signal is modified to reflect binary data.



This technique uses two frequencies,  $f_1$  and  $f_2$ . One of them, for example,  $f_1$  is chosen to represent binary digit 1 and the other one is used to represent binary digit 0. Both amplitude and phase of the carrier wave are kept intact.

### 3) Phase shift keying -

In this conversion scheme, the phase of the original carrier signal is altered to reflect the binary data.



When a new binary symbol is encountered, the phase of the signal is altered. Amplitude and frequency of the original carrier signal is kept intact.

### 4) Quadrature phase shift keying -

The QPSK alters the phase to reflect two binary digits at once. This is done in four different phases. The main

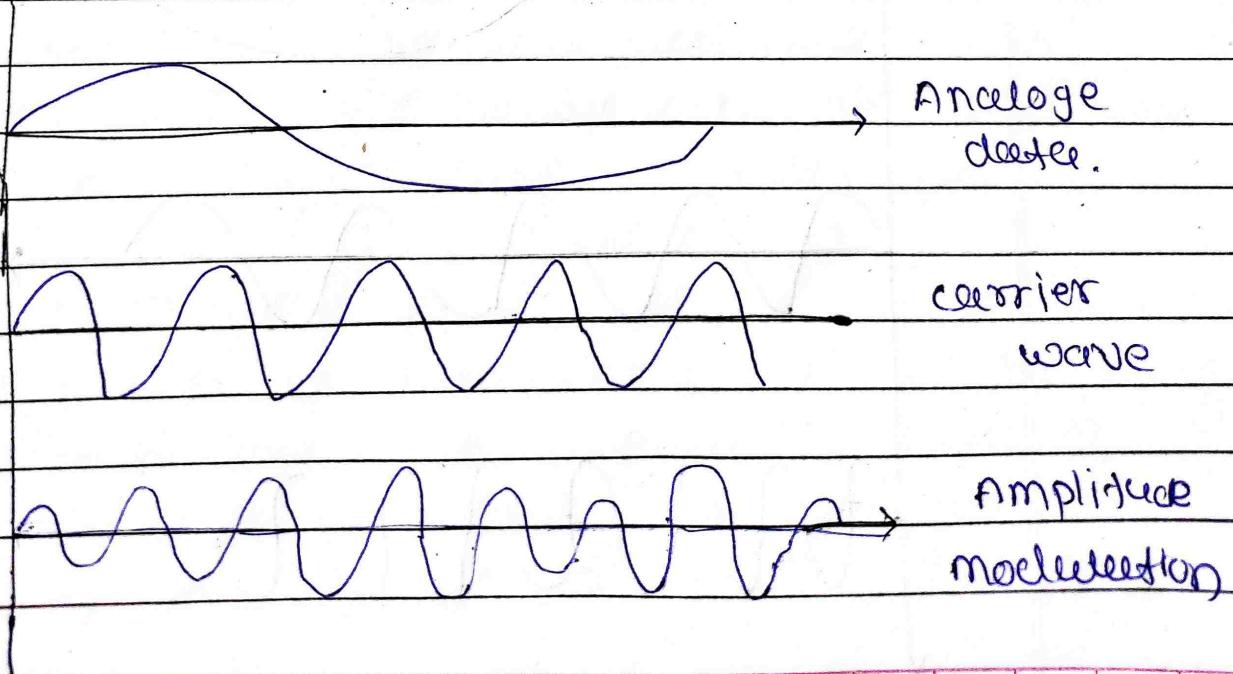
Stream of binary data is divided equally into two sub-streams. The serial data is converted into parallel in both sub-stream and then each stream is converted to digital signal using NRZ technique. Later both the digital signals are merged together.

\* Analog-to-Analog Conversion -

Analog signals are modified to represent analog data. This converted is also known as Analog modulation. Analog-to-Analog conversion can be done in three ways.

1) Amplitude Modulation -

In this modulation, the amplitude of the carrier signal is modified to reflect the analog data.

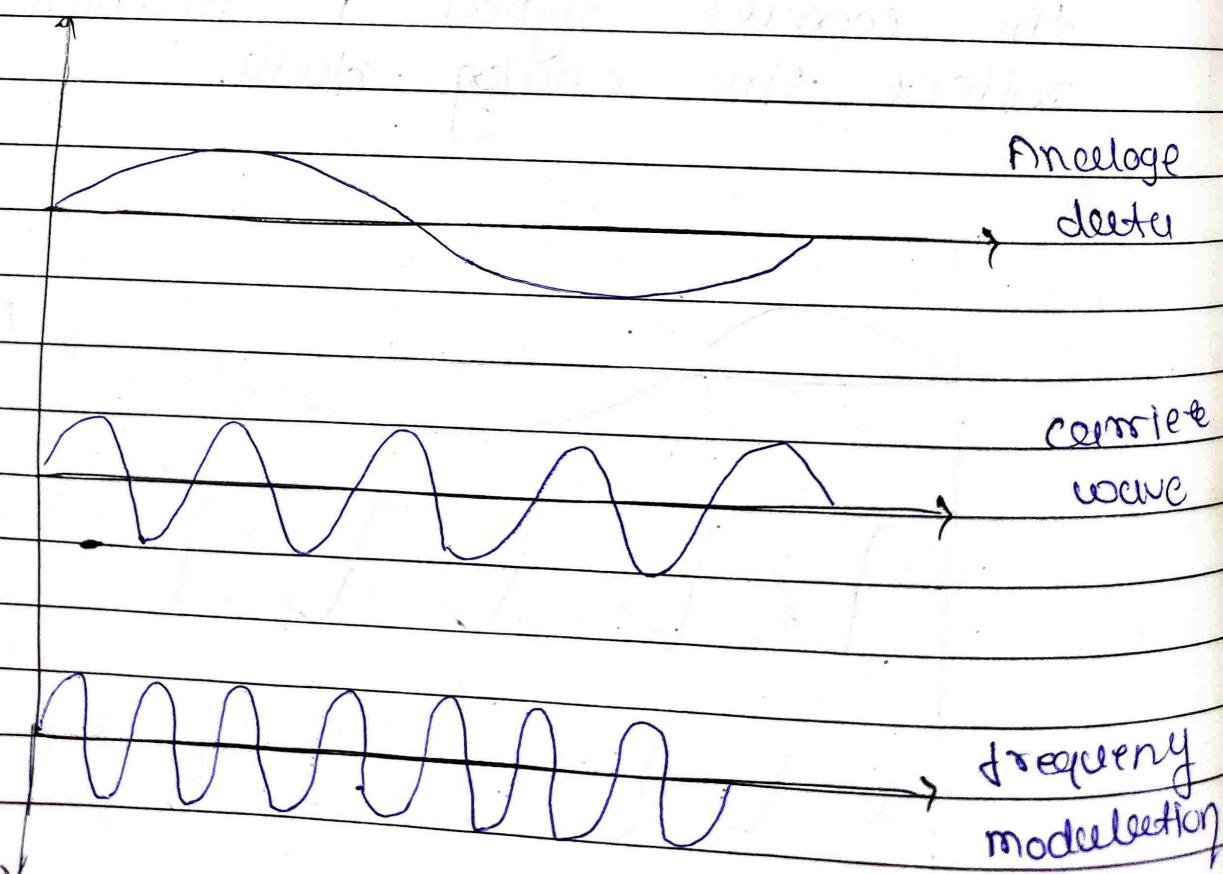


Amplitude modulation is implemented by means of a multiplier. The amplitude of modulating signal (analog dc) is multiplied by the amplitude of carrier frequency, which then reflects analog dutcl. The frequency and phase of carrier signal remain unchanged.

## 2) Frequency Modulation -

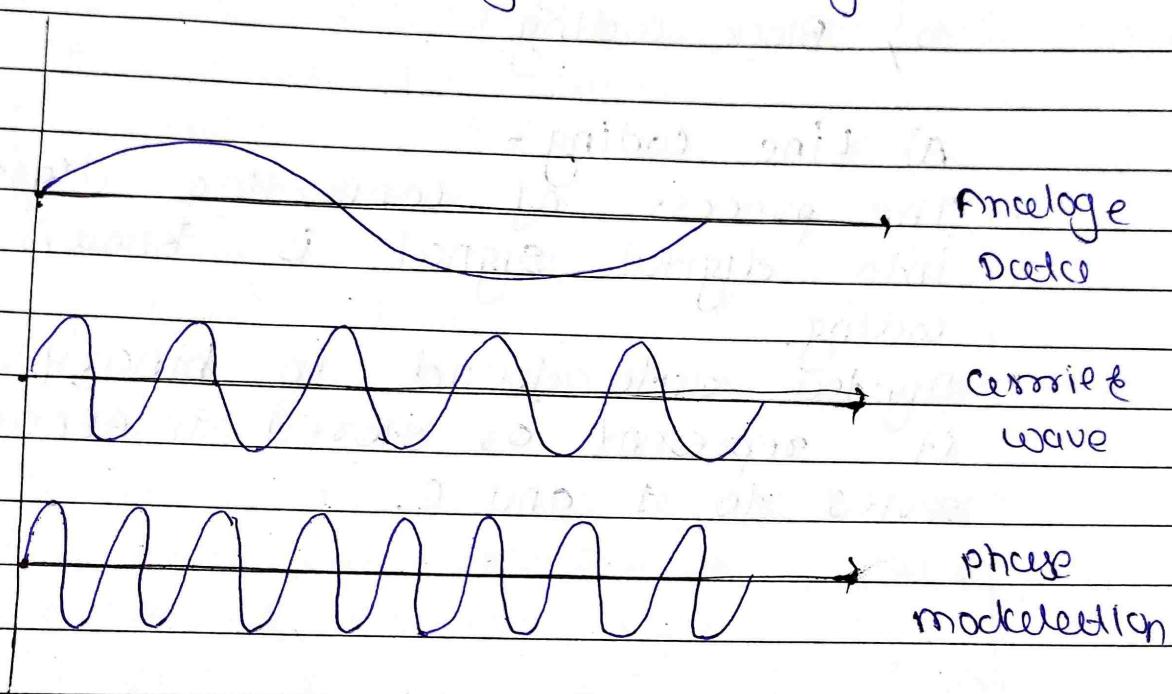
In this modulation technique, the frequency of the carrier signal is modified to reflect the change in the voltage levels of the modulating signal (analog dc).

The amplitude and phase of the carrier signal are not altered.



### 3) phase Modulation -

In the modulation technique, the phase of carrier signal is modulated in order to reflect the change in voltage (amplitude) of analog data signal.



phase modulation is practically similar to frequency modulation, but in phase modulation frequency of the carrier signal is not increased. Frequency of carrier is signal is changed to reflect voltage change in the amplitude of modulating signal.

### \* Digital transmission -

Data can be represented either in analog or digital form. In the complete case the digital form is stored the information. Therefore the data needs to be converted

in digital form.

1) Digital to Digital conversion -

It can be done in two ways.

a) Line coding -

b) Block coding.

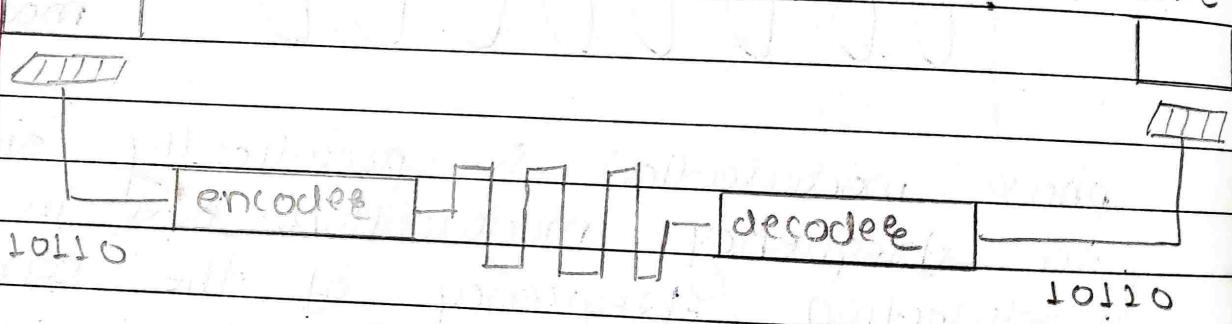
A) Line coding -

The process of converting digital data into digital signal is known as line coding.

Digital data stored in binary format is represented or stored internally as series of 1 and 0.

Sender

Receiver



Digital line coding has three types -

a) Unipolar coding

b) Polar coding

c) Bipolar coding.

a) Unipolar coding -

0 1 0 1 1

- Unipolar encoding scheme using single voltage level to represent data.
- In this case, to present binary 1 high voltage is transmitted, and to represent zero no voltage is transmitted.
- It is also called as unipolar non-return to zero encoding because there is no rest condition that is it either represent 1 or 0.

### b) Pulse coding -

- Pulse coding uses multiple voltage level to represent binary value.
- Pts pulse coding is of four type.
  - Pulse Non Return to zero
  - Return to zero
  - Manchester
  - Differential Manchester

#### • Pulse Non return to zero -

- It uses two differential voltage level to represent binary values generally positive voltage represent 1 and negative values represent 0.
- It is also NRZI because two variant
  - a) NRZ-L
  - b) NRZ-I.

a) NRZ-L -

NRZ-L changes voltage level when different bit count is i.e.  $1 \rightarrow 0$ , and  $0 \rightarrow 1$ .

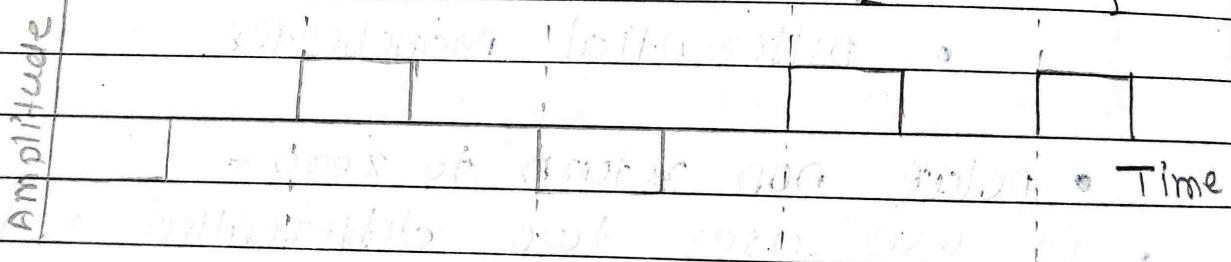
b) NRZ-I -

In NRZ-I voltage change when 1 is encountered.

- Return to zero (RZ) -

RZ uses three voltage levels positive negative or zero.

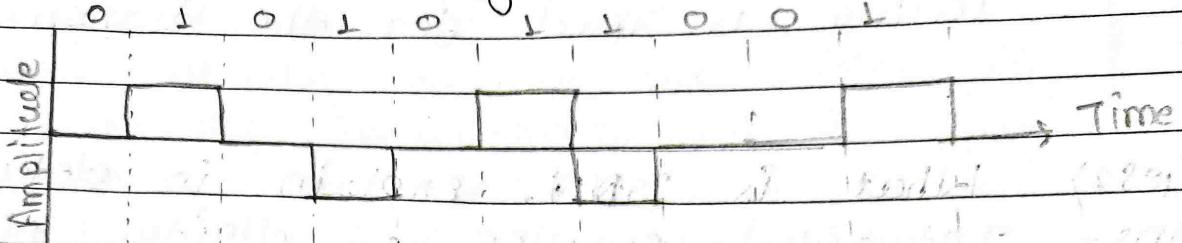
- Positive voltage is represent 1 and negative voltage to represent 0.
- Zero voltage represent none.
- Signal change during bits.



- Manchester -

- This encoding scheme is combination of RZ and NRZ-I.
- Bit time is divided into 2 halves if transmitted in the middle of the bit and change phase when one is encountered.

### c) Bipolar Coding -



Bipolar encoding uses three voltage levels.

- a) positive
- b) Negative
- c) Zero.

### B) Block coding -

To ensure accuracy of received data frame redundant bits are used.

for example -

In even parity, one parity bit is added to make the count of 1's in the frame even by this way no. of bits in frame is increased this is called as blocking coding.

Block coding is represented by "1" notation  $M_B/nB$ , mbit block is subdivided with m-block bit where as  $n > m$  block coding envolve three steps.

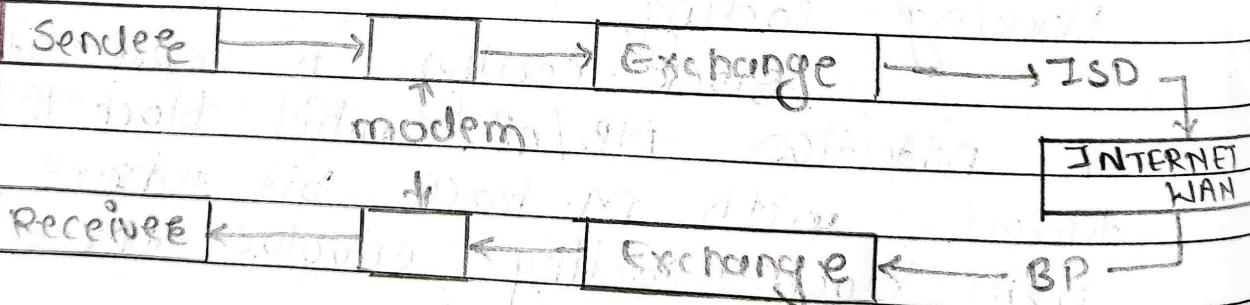
- a) division
- b) Substraction
- c) combination.

Afjer block coding is done line coding is used for the transmission.

Ques 2) What is ISDN, explain in details.

Ans -

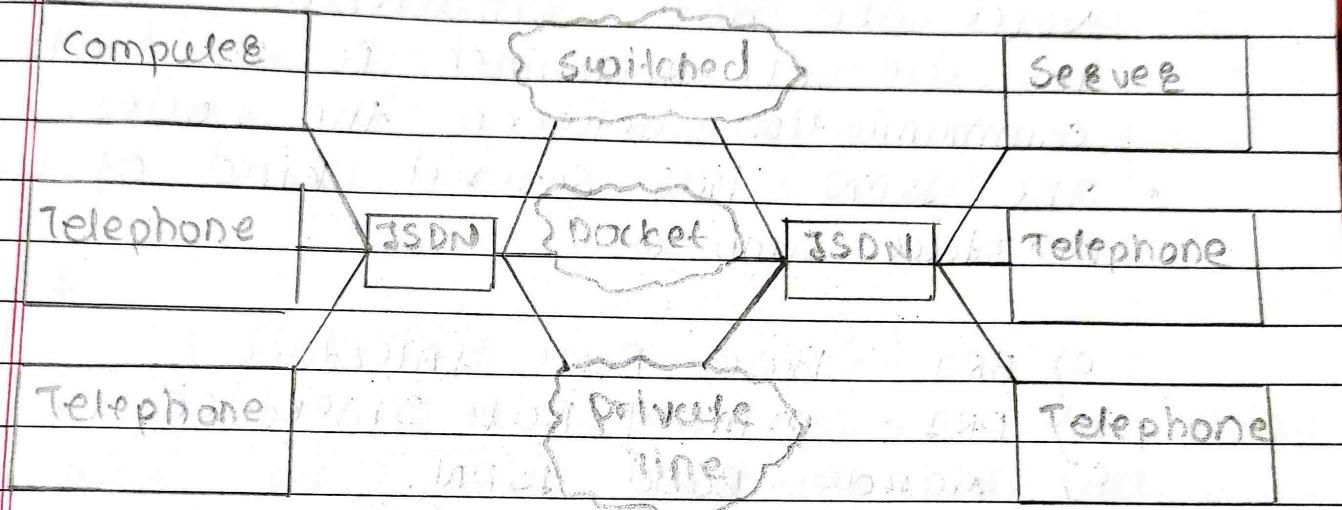
- Integrated service of digitized Network
- ISDN was first define in the CCITT Red book in 1988. In short ISDN is telephone network based, infrastructure which allows the transmission of voice and data simultaneously and a high speed with greater efficiency.
- This is circuit switch telephone network system which also provides access to packet switch network.
- Before ISDN the Internet service uses a device called ~~modem~~ modern modem which you essential thing to establish the connection to the internet.



- Modem perform the process of modulation and demodulation whereas as in modulation the conversion of digital signal into

analog was perform this process.  
processes at the sendee ends.

- Demodulation is the process of conversion of analog signal into digital signal perform at receiver end.
- Andis why modem stands for modulator and demodulator.



### Access Interface of ISDN.

- 1) BRI
- 2) PRI
- 3) Narrowband ISDN
- 4) Broadband ISDN

ISDN support variety of services.

- ① voice call
- ② teletext
- ③ video text
- ④ data transfer
- ⑤ electronic mail
- ⑥ electronic fund transfer
- ⑦ audio-video conferencing
- ⑧ document storage transfer
- ⑨ image and graphic exchange
- ⑩ connection to the internet
- ⑪ facsimile machine

## Types of ISDN -

- Among the type of several interfaces present, some of them contain channels such as B-channels and D-channels.
- B-channels stand for bearer channel whereas meaning of D-channel can be represent as delta channels. The use of B-channel is to element transmit voice and data simultaneously whereas the use of D-channel is used to set communication between the nodes.
- The ISDN has several kind of access interface such as
  - a) BRI - Basic Rate Interface.
  - b) PRI - primary Rate Interface.
  - c) Narrow Band ISDN.
  - d) Broadband ISDN.

### a) BRI → Basic Rate Interface -

It uses existing telephone connection. The configurations provide two data or bearer channels at 64 kbps and one control or delta channel at 16 kbps and one control standard rate of BRI.

### b) PRI - Primary Rate Interface -

- The primary rate interface is also called as primary Rate interface. Its used as by enterprise and offices.

- The PRJ configuration is based on T-carrier or T1 in the US, Canada and Japan consisting of 23 data or bearer channels and one control or data channel with 64 kbps speed for a bandwidth of 1.544 Mbps.
- The PRJ configuration is based on E-carrier or E-1 Europe, Australia and few Asian countries consisting of 30-data or bearer channel and two control or data channel with a speed of 64 kbps for a bandwidth of 2.048 Mbps.

### c) Narrowband ISDN -

- It is also called as p-ISDN. This can be understood as telecommunication that carries voice information in narrow-band of frequencies.
- This is actually an attempt to digitize the analog voice information this uses 64 kbps of circuit switching.

### d) Broadband ISDN -

- B-ISDN integrated digital networking services and provides digital transmission over the ordinary telephone wire as well as over fiber media
- The broadband speed 2 mbps to 2 Gbps and transmission is related to ATM

### (Asynchronous Transfer Mode).

- The broadband ISDN communication is usually made using the fibre optic cable at the speed of B-ISDN. It is greater than 1.54 mbps the communication based on this called as broadband communication.
- The broadband services provides a continuous flow of information which is distributed from a central source to an unlimited number of authorized receive connected to the network.

Ques 3)

What are designing issue of datalink layer?

Ans -

The data link layer in the OSI (open System Interconnection) model, is between the physical layer and network layer. This layer connects the raw transmission facility provided by the physical layer to reliable and error free link.

The main function and the design issues of this layer are:

- 1) providing service to the network layer.
- 2) framing.
- 3) error control.
- 4) flow control.

### 1) Service to the Network Layer -

In the OSI model, each layer uses the services of the layers below it and provides services to the layer above it. The datalink layer uses the services offered by the physical layer. The primary function of this layer is to provide a well defined service interface to network layer above it.

The type of service provided can be of three types.

- a) Unacknowledged connectionless services.
- b) Acknowledged connectionless services.
- c) Acknowledged connection oriented services

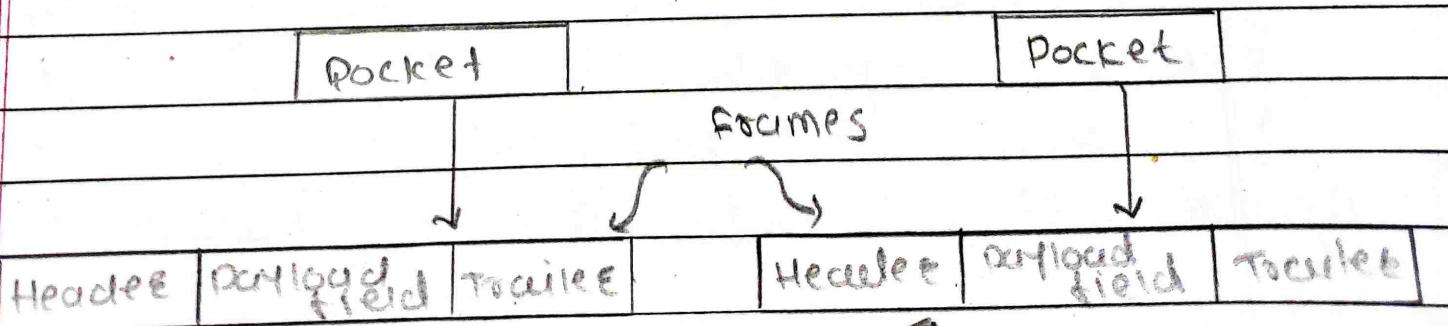
2)

### Framing -

The datalink encapsulates each data packet from the network layer into frames which are then transmitted.

A frame has three part, namely -

- a) Frame Header
- b) payload field that contain the data packet.
- c) Frame trailer



### 3) Error control -

The data link layer ensures error control for data transmission. The issue is to handle errors with respect to error control case.

- i) Dealing with transmission errors.
- ii) Sending acknowledgement frame in reliable connection.
- iii) Retransmitting lost frames.
- iv) Identifying duplicate frames and deleting cause of broadcasting.

### 4) Flow control -

The data link layer regulates flow control so that a fast sender does not drown a slow receiver. When the sender send frames at very high speed a slow receiver may not be able to handle it. There will be frame losses even if there will be frame losses even if the transmission is error-free. The two common approaches for flow control are,

- i) Feedback based flow control.
- ii) Rule based flow control.

Ques: 4) What are sliding window protocol?

Ans -

Sliding window protocol are data link layer protocol for reliable and sequential delivery of data frames. The sliding window is also used in transmission control protocol.

In this protocol, multiple frame can be sent by a sender at a time before receiving an acknowledgement from the receiver. The term sliding window refers to the imaginary boxes to hold frames. Sliding windows method is also known as windowing.

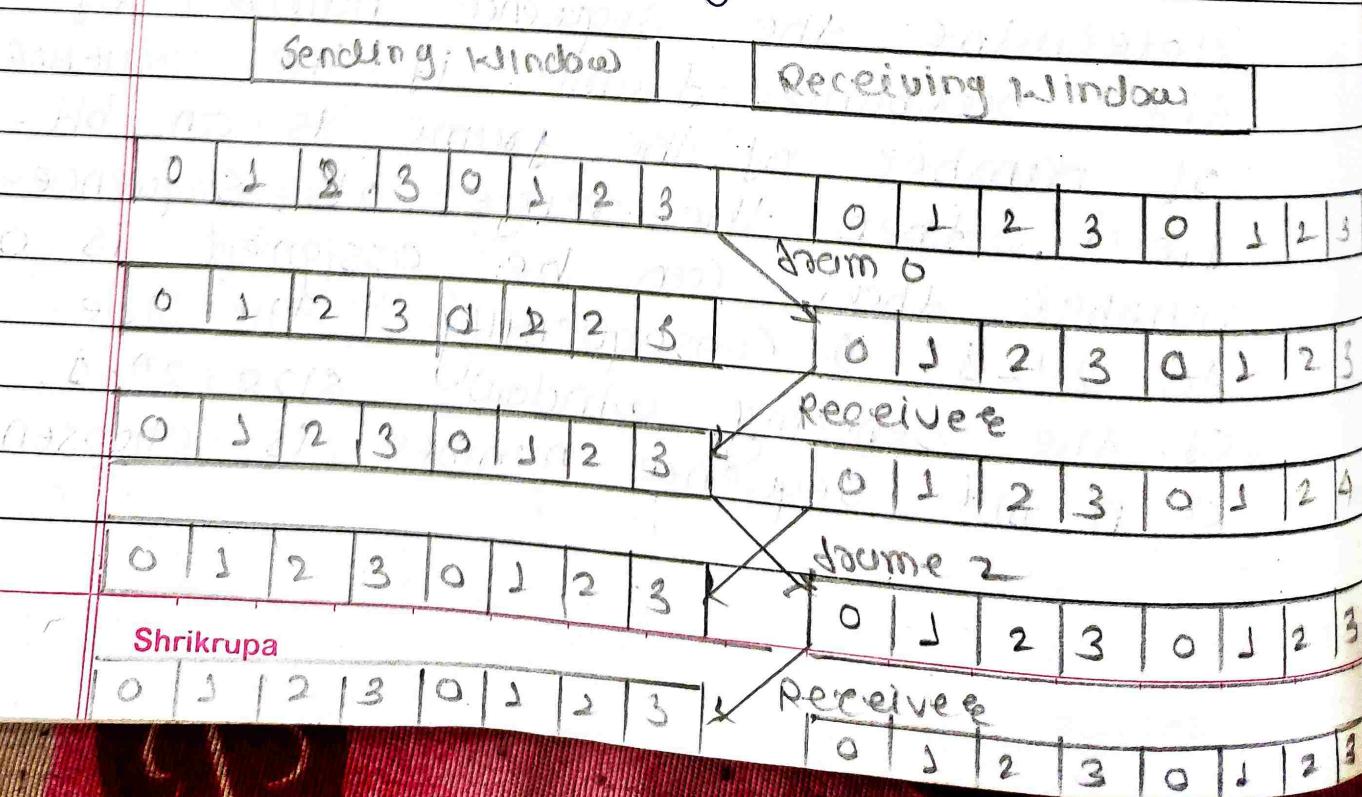
#### \* Working principle -

In these protocol, the sender has a buffer called the sending window and the receiver has buffer called the receiving window.

The size of the sending window determine the sequence number of the outband frame. If the sequence of number of the frame is an bit-field, then the range of sequence number that can be assigned is 0 to  $2^n - 1$ . Consequently, the size of the sending window size  $2^n - 1$ . A n-bit sequence number is chosen.

The sequence numbers are numbered as modulo-n for example - If the sending window size is 4. Then the sequence numbers will be 0, 1, 2, 3, 0, 1, 2, 3, 0, 1 and so on. The number of bits in the sequence number is 2 to generate the binary sequence 00, 01, 10, 11. The size of the receiving window, the maximum number of frames that the receiver can accept at a time. It determine the maximum number of frames that the sender can send before receiving acknowledgement.

Example - Suppose that we have sender window and receiver window each of size 4. So the sequence numbering of both the windows will be 0, 1, 2, 3, 0, 1, 2 and so on. The following diagram shows the position of the window after sending the frames and receiving acknowledgement.



Types of sliding window protocol.

The sliding window ARQ (Automatic Repeat request) protocol can be of two categories.

### 1) G10 - Bank - NARQ -

G10 - Bank - NARQ provides for sending multiple frames before receiving the acknowledgement for the first frame. It uses the concept of sliding window and so is also sliding window protocol. The frames are sequentially numbered and a finite number of frames is sent. If the acknowledgement of a frame is not received within the time period, all frames starting from that frame are retransmitted.

### 2) Selective Repeat ARQ -

The protocol also provides for sending multiple frames before receiving the acknowledgement for the first frame. However, here only the erroneous or lost frames are retransmitted, while the good frames are received and buffered.

Ques 8) Write about Congestion control algorithms.

Ans -

Congestion causes choking of the communication medium. When too many packets are displayed in the method of the subnet, the subnet performance degrades. Hence, a network communication channel is called congestion. If packets are traversing the path and experience delays mainly over the paths propagation delay.

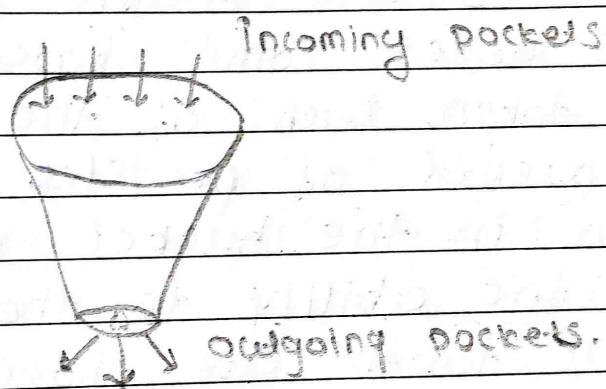
There are two congestion control algorithms which are follows.

### 1) Leaky Bucket -

The leaky bucket algorithm discusses its use in the context of network traffic shaping or rate limiting. The algorithm allows controlling the rate at which an packet is injected into a network and managing burstiness in the data rate.

A leaky bucket execution and a token bucket execution are predominantly used for traffic shaping algorithm this algorithm is used to control the rate at which traffic is sent to the network and shape the burst traffic to a steady traffic stream.

In this algorithm, a bucket with a volume of say  $b$ -bytes and a hole in the Notes bottom is considered. If the bucket is full, it means  $b$  bytes are available in storage. A packet with a size ~~more~~ smaller than  $b$  byte arrives at the bucket and will forward it. If the packet's size increases by more than  $b$  bytes, it will either be discarded or queued. It is also considered that the bucket leaks through the hole, in its bottom at a constant rate of  $r$  bytes per second.



The overflow is considered constant when there is any packet in the bucket and zero when it is empty. This defines when it starts flowing into the bucket faster than data flows out through the hole, the bucket overflows.

### 2) Token bucket Algorithm -

The leaky bucket algorithm has a rigid output design at an average rate independent of the bursty traffic. In some application when large bursts control the output is allowed to speed up, this calls for a more flexible algorithm, preferably one that never loses information therefore, a token bucket algorithm finds its uses in network traffic shaping or rate limiting.

It is a control algorithm that indicates when traffic should be sent. This order comes based on the display of tokens. Each of the tokens defines a packet of predefined fixed size. Token in the bucket are deleted for the ability to share a packet when token are shown, a flow to transmit traffic appears in the display of tokens.

No token means no flow sends its packets. Hence, a flow transmits traffic up to its peak burst rate in good token in the buckets.

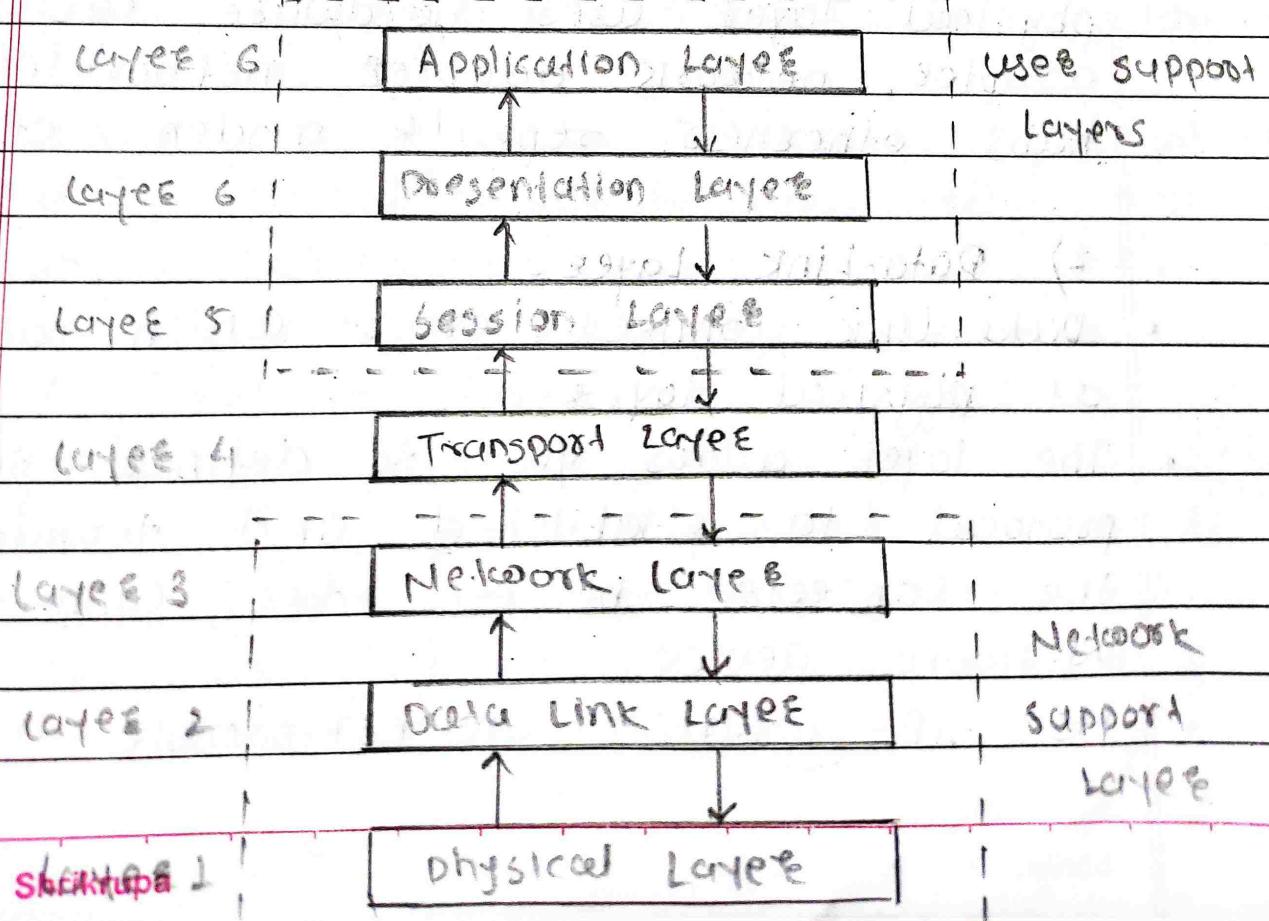
Ques 6) What is OSI reference model.

Write about network structure and architecture of OSI layers?

Ans -

In 1970 the ISO conducted a program to develop general standard and method of networking. In 1973 an experimental packet switched system in the UK identified the requirement for defining high level protocols. In 1983 OSI model was initially intended to be detailed specification of session oriented interfaces. In 1984 the OSI architecture was formally adopted by ISO as an international standard.

\* Seven layers of the OSI-model -



OSI model is layered seven architecture system in which layer is defined according to specific function to perform all these seven layers work collaborately to transmit the data from one layer to another.

### 1) Physical Layer -

- Physical layer help you to define the electrical and physical specification of the data connection.
- The level established a relationship between a device and physical transmission medium.
- The physical layer is not concern with protocol or other such higher level layers.
- For example, physical layer uses hardware cables, adapter, network adapter, networking hubs, switches, repeater, modem, etc.

### 2) Data-Link Layer -

- Data link connect error which occurs at physical layer.
- The layer allows you to defined the protocol to establish and terminate the connection between two connected network device.
- Its IP- address understandable layer.

which help you to define logical addressing  
and end point to be identified.

- This layer helps you implement routing  
of packets of network.
- It help you to define path and the  
data-link layer is sub-divided in two  
layer
  - a) MAC - media Access control.
  - b) LLC - logical Links control.

### 3) Network Layer -

- Network layer provides the functional and  
procedural means of transferring data  
sequence from one node to another  
connected in descendant network.
- Network message delivery at network layer  
doesn't give any guarantee to be reliable.
- It uses routing protocol, multicast  
group management, network layer addressing  
assignment.
- Router is used at network layer which  
uses shortest algorithm to define route  
for destination.

### 4) Transport Layer -

- Transport layer decided how much data  
should be sent and what to eat. This  
layer ensure that data unit data  
unit are delivered error free and  
in sequence.

- It controls the reliability through flow control, error control and segmentation or de-segmentation. It uses acknowledgement of the successful data send next data in case.
- No error occurs for this uses TCP protocol and also UDP protocol.

### 5) Session Layer -

- It is layer which is responsible for establishing, maintaining and terminating the connection.
- This layer handle all the important logs and password validation.
- Session layer offer services like dialogue discipline. It can be duplex or half duplex.

### 6) Presentation Layer -

- It handles data compression and de-compression. This layer is also known as syntax layer.
- This layer is responsible for formatting of data according to user or application requirement.

### 7) Application Layer -

It is highest level layer on OSI model and it interacts with OS model of software.