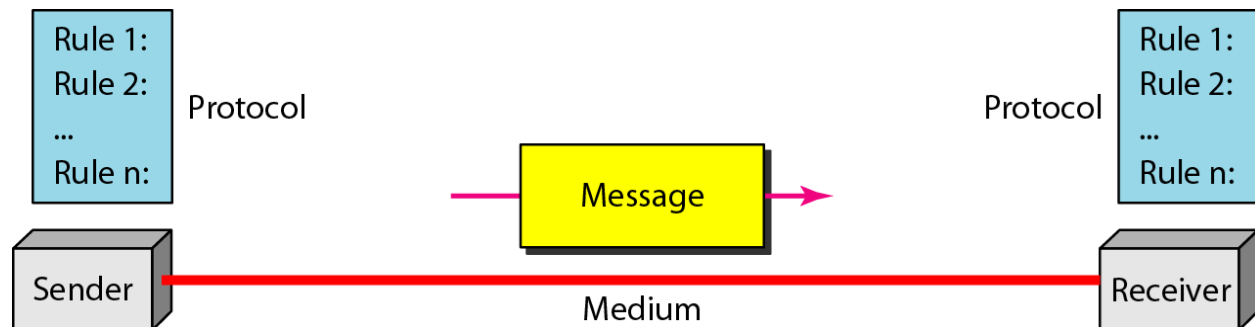


1. Identify and explain the components of a complete data communication system.



1. **Message :**

This is most useful asset of a data communication system. The message simply refers to data or piece of information which is to be communicated. A message could be in any form, it may be in form of a text file, an audio file, a video file, etc.

2. **Sender :**

To transfer message from source to destination, someone must be there who will play role of a source. Sender plays part of a source in data communication system. It is simple a device that sends data message. The device could be in form of a computer, mobile, telephone, laptop, video camera, or a workstation, etc.

3. **Receiver :**

It is destination where finally message sent by source has arrived. It is a device that receives message. Same as sender, receiver can also be in form of a computer, telephone mobile, workstation, etc.

4. **Transmission Medium:**

In entire process of data communication, there must be something which could act as a bridge between sender and receiver, Transmission medium plays that part. It is physical path by which data or message travels from sender to receiver. Transmission medium could be guided (with wires) or unguided

(without wires), for example, twisted pair cable, fiber optic cable, radio waves, microwaves, etc.

5. Set of rules (Protocol):

To govern data communications, various sets of rules had been already designed by the designers of the communication systems, which represent a kind of agreement between communicating devices. These are defined as protocol. In simple terms, the protocol is a set of rules that govern data communication. If two different devices are connected but there is no protocol among them, there would not be any kind of communication between those two devices. Thus the protocol is necessary for data communication to take place.

2.Explain the characteristics that the effectiveness of a data communication system depends on.

The effectiveness of a data communications system depends on four fundamental characteristics: delivery, accuracy, timeliness, and jitter.

1. Delivery:

The system must deliver data to the correct destination. Data must be received by the intended device or user and only by that device or user.

2. Accuracy:

The system must deliver the data accurately. Data that have been altered in transmission and left uncorrected are unusable.

3. Timeliness:

The system must deliver data in a timely manner. Data delivered late are useless. In the case of video and audio, timely delivery means delivering data as they are produced, in the same order that they are produced, and without significant delay. This kind of delivery is called real-time transmission.

4. Jitter:

Jitter refers to the variation in the packet arrival time. It is the uneven delay in the delivery of audio or video packets. For example, let us

assume that video packets are sent every 30 ms. If some of the packets arrive with

30ms delay and others with 40-ms delay, an uneven quality in the video is the result.

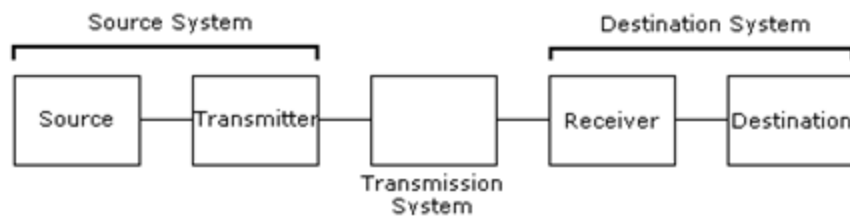
3.What is meant by data communication?

The term telecommunication means communication at a distance. The word data refers to information presented in whatever form is agreed upon by the parties creating and using the data. Data communications are the exchange of data between two devices via some form of transmission medium such as a wire cable.

4.Difference between digital and analog system.

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.

5.Explain a simplified data communication model.



Source

It is the generator of data that will pass on the destination using networks. Without any request source never passes the data to destination. So, if source is passing the data means any of the destinations is requesting for data using some query languages.

Transmitter

It is simply a device used to convert the data as per the destination requirement.

Transmission System

To transmit the data on different connected systems we use different transmission systems. Data transmission using transmission system means the physical transfer of data over point-to-point or point-to-multipoint communication channels.

Receiver

This receives the signals from the transmission system and converts it into a form that is suitable to the destination device.

Destination

It is simply a device for which source device sends the data.

6.Simplex, half-duplex, full duplex-

Simplex mode:

In simplex mode, Sender can send the data but that sender can't receive the data. It is a unidirectional communication.

Half-duplex mode:

In half duplex mode, Sender can send the data and also can receive the data but one at a time. It is two-way directional communication but one at a time.

Full duplex mode:

In full duplex mode, Sender can send the data and also can receive the data simultaneously. It is two-way directional communication simultaneously.

7. Define bandwidth and spectrum of a signal.

Bandwidth: The bandwidth of a composite signal is the difference between the highest and the lowest frequencies contained in that signal.

Spectrum: Spectrum refers to the invisible radio frequencies that wireless signals travel over. Those signals are what enable us to make calls from our mobile devices, tag our friends on Instagram, call an Uber, pull up directions to a destination, and do everything on our mobile devices. The frequencies we use for wireless are only a portion of what is called the electromagnetic spectrum.

8. Define block coding and its purpose.

Block coding: 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.

9. What is throughput?

Throughput is the actual amount of data that is successfully sent/received over the communication link. Throughput is presented as kbps, Mbps or Gbps, and can differ from bandwidth due to a range of technical issues, including latency, packet loss, jitter and more.

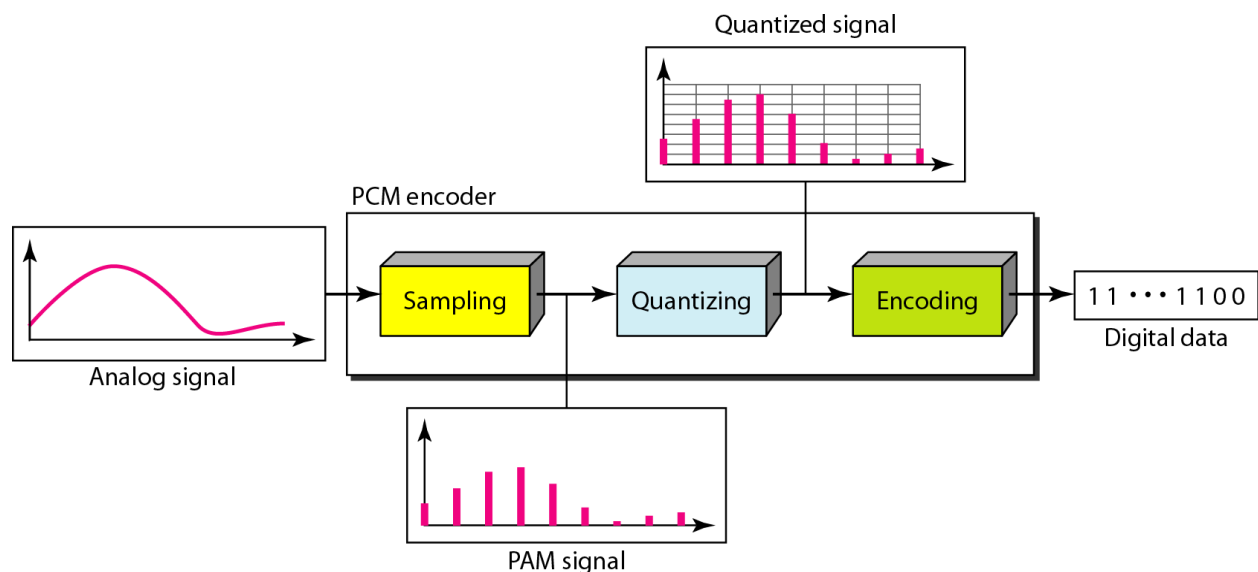
10. Explain modulation technique for delta modulation.

- i. This scheme sends only the difference between pulses, if the pulse at time t_{n+1} is higher in amplitude value than the pulse at time t_n , then a single bit, say a "1", is used to indicate the positive value.

- ii. If the pulse is lower in value, resulting in a negative value, a "0" is used.
- iii. This scheme works well for small changes in signal values between samples. If changes in amplitude are large, this will result in large errors.

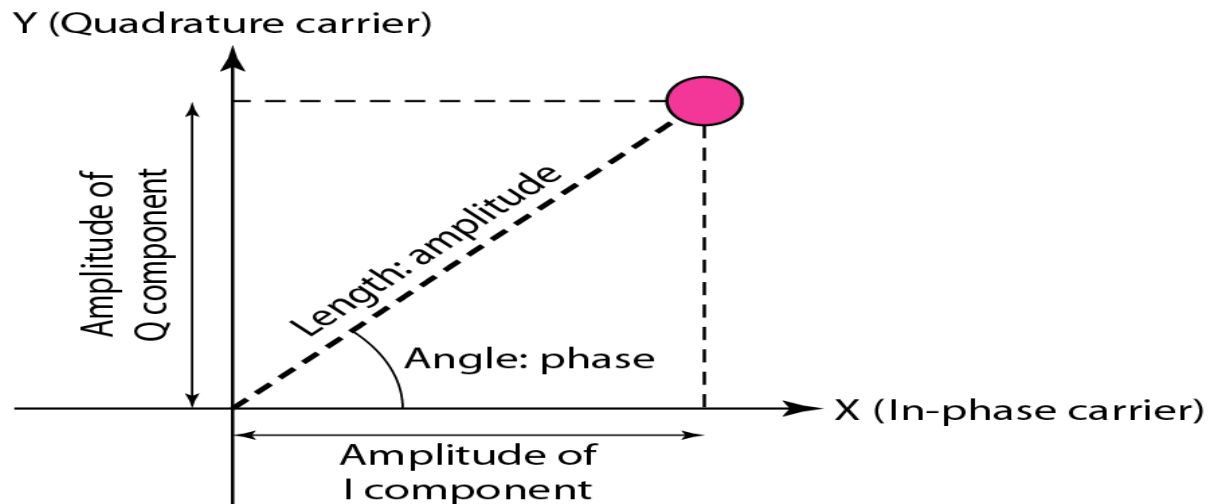
11.Explain pulse code modulation process with diagram.

- PCM consists of three steps to digitize an analog signal:
 1. Sampling
 2. Quantization
 3. Binary encoding
- Before we sample, we have to filter the signal to limit the maximum frequency of the signal as it affects the sampling rate.
- Filtering should ensure that we do not distort the signal, ie remove high frequency components that affect the signal shape.



12.Define 4-PSK/ QPSK method with constellation diagram.

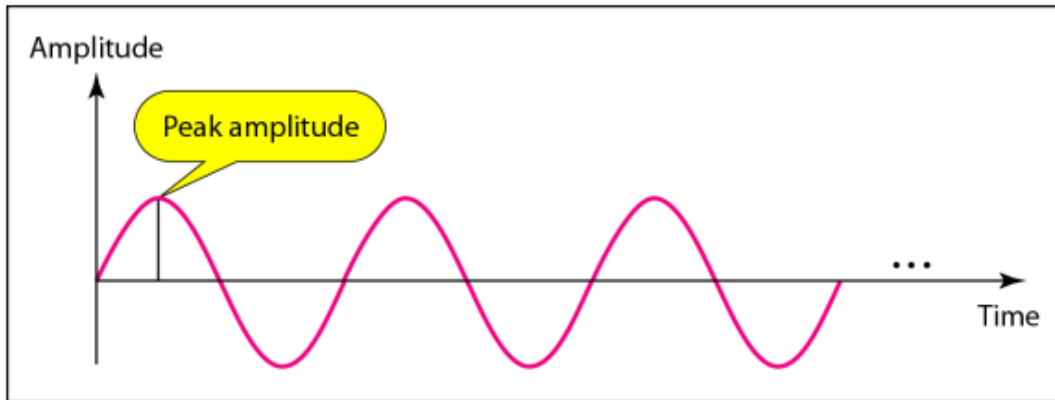
- A constellation diagram helps us to define the amplitude and phase of a signal when we are using two carriers, one in quadrature of the other.
- The X-axis represents the in-phase carrier and the Y-axis represents quadrature carrier.



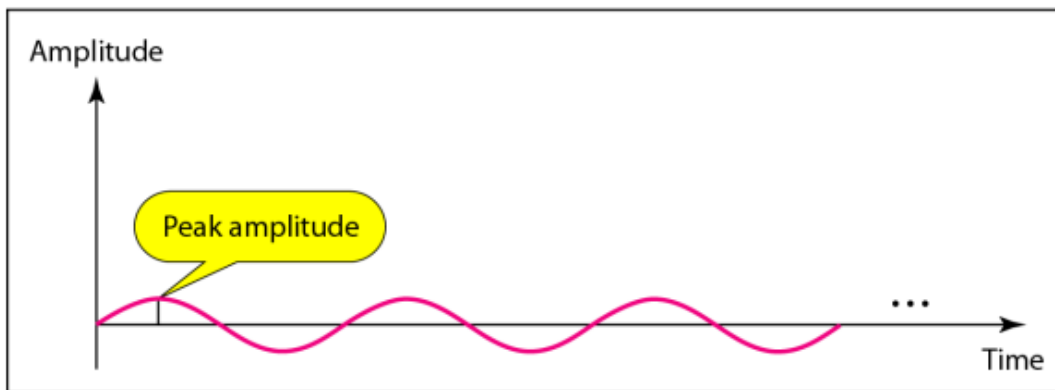
13. What is modulation? Purpose of carrier signal in modulation?

Modulation is the process of encoding information from a message source in a way that is suitable for transmission. This is achieved by altering the characteristics of a wave.

14. Two signals with the same phase and frequency, but different amplitudes

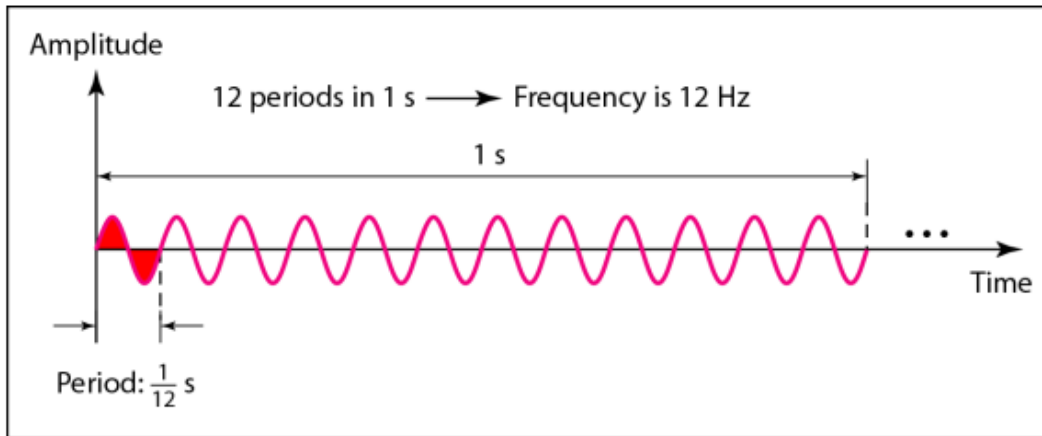


a. A signal with high peak amplitude

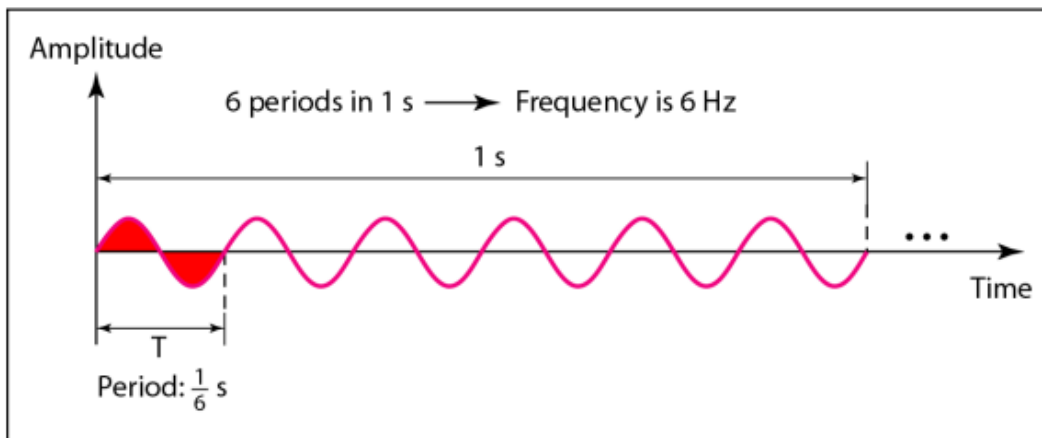


b. A signal with low peak amplitude

15. Two signals with the same amplitude and phase, but different frequencies



a. A signal with a frequency of 12 Hz



b. A signal with a frequency of 6 Hz

16. Define Baseline wandering and its effectiveness

A receiver will evaluate the average power of the received signal (called the baseline) and use that to determine the value of the incoming data elements. If the incoming signal does not vary over a long period of time, the baseline will drift and thus cause errors in detection of incoming data elements. ■ A good line encoding scheme will prevent long runs of fixed amplitude.

17 . Why Scrambling technique is used?

The best code is one that does not increase the bandwidth for synchronization and has no DC components. ■ Scrambling is a technique used to create a sequence of bits that has the required c/c's for transmission - self clocking, no low frequencies, no wide bandwidth. ■ It is implemented at the same time as encoding, the bit stream is created on the fly. ■ It replaces 'unfriendly' runs of bits with a violation code that is easy to recognize and removes the unfriendly c/c

18. Define Periodic signal and frequency spectrum?

Periodic analog signals can be classified as simple or composite. A simple periodic analog signal, a sine wave, cannot be decomposed into simpler signals. A composite periodic analog signal is composed of multiple sine waves.

Frequency spectrum of a signal is the range of frequencies contained by a signal.

19. What do you mean by Attenuation?

Means loss of energy -> weaker signal-when a signal travels through a medium it loses energy overcoming the resistance of the medium v Amplifiers are used to compensate for this loss of energy by amplifying the signal.

20. Define PCM,PFM,PTM,PFM

PCM consists of three steps to digitize an analog signal: 1. Sampling 2. Quantization 3. Binary encoding ♣ Before we sample, we have to filter the signal to limit the maximum frequency of the signal as it affects the sampling rate.

PTM is a combination of **PWM** (Pulse Width Modulation) and **PPM** (Pulse Position Modulation). The modulation and demodulation of both types of PTM are closely related.

Pulse-frequency modulation (PFM) is a [modulation](#) method for representing an [analog signal](#) using only two levels (1 and 0).

21. What is VSAT? How does it work? Characteristics of VSAT?

VSAT (Very Small Aperture Terminal) is a satellite communications system that serves home and business users.

A VSAT end user needs a box that interfaces between the user's computer and an outside antenna with a transceiver. The transceiver receives or sends a signal to a satellite transponder in the sky. The satellite sends and receives signals from an earth station computer that acts as a hub for the system. Each end user is interconnected with the hub station via the satellite in a star topology. For one end user to communicate with another, each transmission has to first go to the hub station which retransmits it via the satellite to the other end user's VSAT. VSAT handles data, voice, and video signals.

22. What do you mean by active and passive satellite?

An active satellite is one which has transmitting equipment aboard, such as a transponder, a device which receives a signal from Earth, amplifies it, and retransmits the same signal back to Earth (either immediately or after a delay)

A passive satellite is the one that just reflects the signal from one earth station to other earth station(s) without any amplification or retransmission.

23. State some applications for each type of satellites.

- Communications Satellite
- Remote Sensing Satellite
- Navigation Satellite
- Geocentric Orbit type satellites - LEO, MEO, GEO
- Global Positioning System (GPS)
- Geostationary Satellites (GEOs)
- Drone Satellite
- Ground Satellite

- Polar Satellite
- Nano Satellites, CubeSats and SmallSats