Digital Communication Lab Viva Questions with Answers

1. List down the major advantages and disadvantages of analog communication techniques?

The major advantages of analog communication are:
(a) For audio and video transmission, analog signals are mostly suited
(b) It can be ported easily
(c) They can be processed easily
(d) Bandwidth usage is less than digital signals
(e) For analog signals, the need of new graphics board is not necessary.
(f) Analog signals can present more refined information because of its higher density
The disadvantages of analog communication are:
(a) The signal quality of analog signal is very less as compared with digital signals
(b) The analog cables are easily affected by external influences.
(c) The circuit complexity is very high for analog communication
(d) This mode of communication is not reliable
(e) The cost of devices is high
(f) This requires more power for transmission.

2. List down the advantages and disadvantages of digital communication techniques?

The major advantages of digital communication are:
(a) Digital communication is more reliable than analog communication
(b) Since the digital signals are less affected by noise, the amount of noise and distortion is very less in digital communication as compared to analog signals.
(c) Digital circuits are cost effective and can be designed easily.
(d) The channel capacity can be efficiently used by digital signals.
(e) Digital signals can easily configure than analog signals
(f) Errors occurred in digital signals can be easily corrected.
(g) The effect of cross-talk is less in digital signals.
(h) Combining of digital signals is easier than combining analog signals
(i) The retrieving of digital signals is very easy than analog signals
(j) Digital circuits consume less power.

The disadvantages of digital communication are:
(a) Digital communication needs to be synchronized (for synchronous transmission purposes)
(b) The required transmission bandwidth is high for digital signals (since, the data rate is high)

3. Write down any 7 different digital modulation techniques you know?

The different types of digital modulation techniques are:

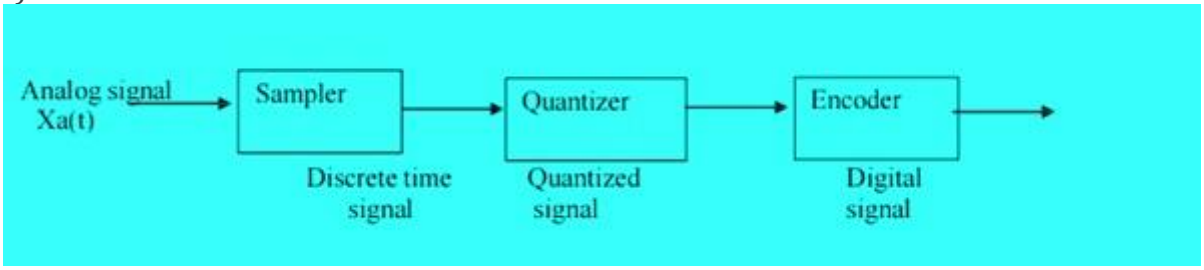
(a) Pulse Code Modulation (PCM)
(b) Differential Pulse Code Modulation (DPCM)
(c) Amplitude Shift Keying (ASK)
(d) Frequency Shift Keying (FSK)
(e) Phase Shift Keying (PSK)

(f) Delta Modulation
(g) Adaptive delta modulation etc...

4. Write down the major blocks used for the conversion of analog to digital signal?

The blocks used for the conversion of analog to digital signals are:

(i) Anti-aliasing filter
(ii) Sampler
(iii) Quantizer
(iv) Encoder



5. List down the different types of coding techniques you know?

The different types of coding techniques are:

(a) Pulse Code Modulation (PCM)
(b) Differential Pulse Code Modulation (DPCM)
(c) Delta Modulation
(d) Adaptive delta modulation

6. What you know about sampling?

One can define sampling as the process of conversion of continuous time analog signal to its corresponding discrete form. Simply we can compare the sampling process to 'cut a bread into slices'.

7. What are the functions of a sampler and quantizer?

The use of sampler is to convert a continuous time signal to its corresponding discrete form

The application of quantizer is to convert a continuous in amplitude signal to its discrete in amplitude signal.

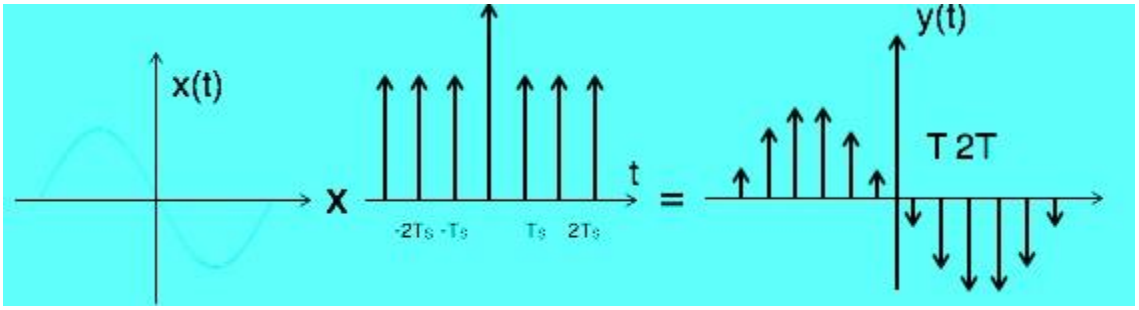
8. What you know about sampling theorem and the Nyquist rate?

As per sampling theorem, the signal reconstruction of sampled signals is possible if and only if the sampling frequency is greater than or equal to twice the maximum frequency present in the message signal.
i.e., $f_s \geqslant 2f_m$
If the sampling rate is equal to twice the maximum frequency of the signal, then that type of sampling can be termed as the Nyquist rate. $f_s = 2f_m$

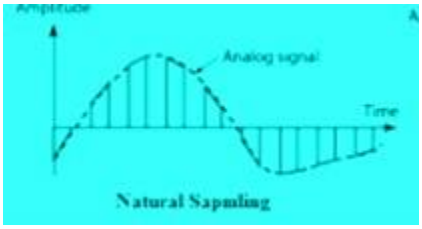
9. List down and draw different types of sampling techniques?

The different types of sampling techniques are:

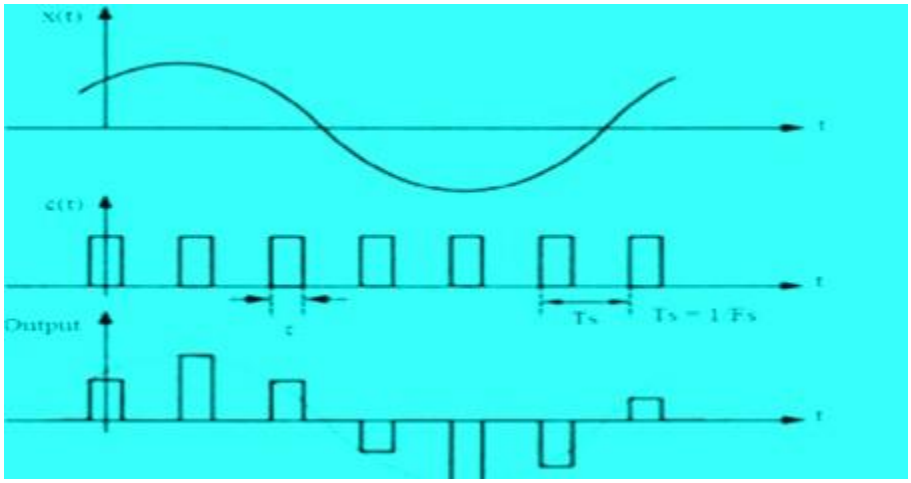
(a) Impulse sampling



(b) Natural sampling



(c) Flat top sampling



10. Write down the different analog pulse modulation techniques?

The different analog pulse modulation techniques are:

(a) Pulse Width Modulation (PWM)
(b) Pulse Amplitude Modulation (PAM) and
(c) Pulse Position Modulation (PPM)

11. Define PAM, PWM and PPM?

In Pulse amplitude modulation (PAM), the amplitude of the carrier (pulse height) is proportional to the amplitude of the message signal.

In pulse width modulation, pulse width of the carrier signal is proportional to the message signal's amplitude.

In pulse position modulation, the pulse position of the carrier signal is proportional to the message signal's amplitude.

12. Compare PAM, PWM and PPM?

Basis for Comparison	PAM	PWM	PPM
Varying parameter	Amplitude	Width	Position
Immunity towards noise	Low	High	High
Signal to noise ratio	Low	Moderate	Comparitively high
Need of synchronization pulse	Not exist	Not exist	Exist
Bandwidth dependency	On pulse width	On rise time of pulse	On rise time of pulse
Transmission power	Variable	Variable	Constant
Bandwidth requirement	Low	High	High
Similarity of implementation	Similar to AM	Similar to FM	Similar to PM
Synchronization between Transmitter and Receiver	Not needed	Not needed	Needed

13. How you calculate the bandwidth of a BPSK signal?

If Fc is the carrier frequency of a BPSK signal, then the bandwidth (B) is B = 2 Fc

14. What you understand about Amplitude Shift Keying (ASK)?

If the variations in the amplitude of a carrier wave represents the digital data, then that type of amplitude modulation is said to be Amplitude Shift Keying (ASK). The binary symbol d-amplitude carrier wave and fixed frequency for a bit length of T seconds are used in an ASK method.

15. What you know about Frequency Shift Keying (FSK)?

As per the changes of the digital signal, if the frequency of the carrier signal varies, then that type of frequency modulation is said to be as FSK. If the message frequency is greater than the carrier frequency, then it is represented by '1' and represents '0' if the message frequency is less than the carrier frequency.

16. What you understand about Phase Shift Keying (PSK)?

At a particular time by varying the sine and cosine inputs, if the phase of the carrier signal is changed, then it is said to be PSK. The '180^0' phase shift carrier wave represents '0' and '0' phase shift carrier wave is representing '1'.

17. Explain about Binary Phase Shift Keying (BPSK)?

In BPSK, for each binary data (0 or 1), the phase of the carrier signal is changed to 0 or 180 degrees.

18. What you understand about the Quadrature Phase Shift Keying 9QPSK)?

The phase of the carrier wave is changed to four different shifts (45, 135, -45 and -135) for each two bits of binary data's (00, 01, 10 and 11).

19. Compare B-W, Power, Probability of error and S/N of ASK, FSK and PSK?

Bandwidth: FSK > PSK > ASK
Power: PSK = FSK > ASK
Probability of error: FSK< PSK < ASK
Signal to Noise Ratio: FSK > PSK > ASK

20. Which modulation technique is known as ON-OFF keying. Justify your answer?

The Amplitude Shift Keying (ASK) modulation is known as ON-OFF keying.

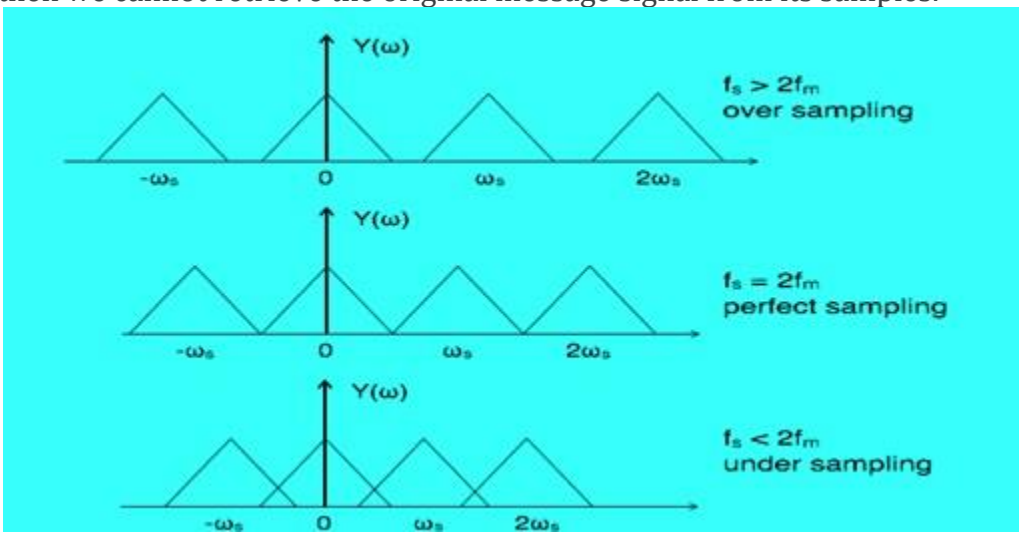
In ASK modulation scheme, if the input is 0, then the output is also 0 and if the input is '1' , the output is the carrier signal. Hence ASK is also termed as ON-OFF keying.

21. Give the differences between bit rate and baud rate?

Per unit time, the number of bits transmitted gives the bit rate. Per unit time, he number of signal units transmitted gives the baud rate.

22. Explain the aliasing effect of sampling?

When the sampling frequency becomes less than the Nyquist rate, then the original signal cannot be recovered from its samples and this effect is termed as aliasing effect. If aliasing occurs , then we cannot retrieve the original message signal from its samples.



23. What is Digital Communication?

The information-carrying digital signal is processed in a digital communication system so that it may be represented by a binary digit sequence (discrete messages). Then it's utilized for ON/OFF keying of a high-frequency sinusoidal carrier wave's amplitude, phase, or frequency, among other things.

If the message signal is analog, sampling, quantizing, and encoding are used to transform it to digital.

24. What is a digital communication system's primary feature?

A digital communication system's primary purpose is that it sends a signal waveform from a finite set of possible waveforms over a finite period. The receiver must detect which waveform from a finite collection of waveforms was delivered by the transmitter from a received noise-perturbed signal.

25. What is meant by Regeneration?

One of the techniques for correcting signal processing is regeneration. The received pulse is increased by a digital amplifier in Regeneration, which restores its original perfect form. The pulse is therefore renewed or recreated. Regenerative repeaters are circuits that execute this function at regular intervals across a transmission system.

26. Specify the benefits of digital communication

• To maintain a high level of communication confidentiality, very sophisticated encryption and decryption methods are available for digital data.

• Through error identification and repair, digital approaches may achieve extremely low error rates and great signal fidelity.

• Using 'Regenerative repeaters,' you can get a powerful, error-free signal at a reasonable power level.

• Digital circuits are less prone to distortion and interference than analog circuits, allowing for simple signal processing and image processing procedures such as speech and picture signal compression.

27. List down the major limitations of digital communication.

• As compared to analog communication systems, digital communication systems require higher bandwidth.

• At various levels, digital systems must allocate a large portion of their resources to synchronization.

• When the signal-to-noise ratio falls below a specific level, service quality might switch from excellent to bad in an instant.

28. Give a list of all available digital communication channels.

I. Wireline channels using a physical media

1. Twisted wire pair (STP, UTP)
2. Coaxial Cable
3. Optical Fibre cable

II. Wireless channels using free space

1. Microwave radio channel
2. Satellite channel
3. Wireless broadcast channel
4. Wireless mobile channel

29. What is a signal? Write the classification of signals

A signal is a single-valued time function that delivers information. The signals are mainly classified into four categories.

1. Deterministic and Random signals
2. Periodic and Non-periodic signals
3. Analog and Discrete signals
4. Energy and Power signals
5. The Unit Impulse Function

30. Define deterministic and random signals.

When there is no uncertainty about a signal's value at any given instant, it is said to be deterministic.
If there is any uncertainty before a signal occurs, it is said to as random.

31. Define periodic and non-periodic signals.

A signal x(t) can be said to be periodic in time, if there exists a constant $T_o > 0$ such that
$x(t) = x(t+T_o)$ for $-\infty \leq t \leq \infty$
where 't' indicates time.
A signal x(t) for which there is no value of to that satisfies the equation
$x(t) = x(t+T_o)$ for $-\infty \leq t \leq \infty$
is called a non-periodic signal

32. Define analog and discrete signals

An analog signal x(t) is a continuous function of time; that is, x(t) is unique for all t values.
x(kT) is a discrete signal that only exists at discrete times. It is defined as a sequence of integers kT, where k is an integer and t is a fixed time interval, for each time.

33. Define energy and power signal

A signal x(t) is said to be an energy signal if, and only if, it has non-zero but finite energy ($0 < E_x < \infty$) for all time.
A signal x(t) is defined as a power signal if, and only if, it has finite but non-zero power ($0 < p_x < \infty$) for all time.

34. Define Unit Impulse Function

An infinitely large amplitude pulse with zero pulse width and unity weight (area beneath the pulse) is defined as the impulse function, which is focused at the place where its argument is zero. The following relationships characterize the unit impulse.

$$\int_{-\infty}^{\infty} \delta(t)\,dt = 1,\ \delta(t) = 0 \text{ for } t \neq 0$$

35. Define information capacity. What is Shannon's limit for information capacity

The maximum rate at which data may be transferred through a channel without error is referred to as the information capacity. The Shannon channel capacity theorem establishes a basic restriction on the pace at which error-free data may be sent. It's as follows:
$C = B \log_2(1+S/N)$, bits/s
where C = Channel capacity
B = Bandwidth
S/N = Signal to noise power ratio

36. What is meant by data transmission? What are its types?

The transfer of data includes digitized voice, digital image and video, computer produced data, and so on. Data transmission may be divided into two categories. There are two types of transmission: 1) parallel transmission and 2) serial transmission. In serial transmission, there are two options. There are two types of transmission: 1) synchronous and 2) asynchronous.

37. What is the parallel transmission? What are its merits?

We transfer a word or byte at a time in parallel transmission. As a result, all of the bits of data are sent out at the same time on distinct communication channels. Parallel transmission mainly has three advantages. They are:
1. Fast data transmission
2. Less complexity
3. Easy to isolate any data line

38. What is the serial transmission? What are its merits?

Data is transmitted as a single bit at a time in serial transmission, with each bit having a predetermined time interval. As a result, serial transmission is simply only a single pair of cables or lines. Serial transmission has the following advantages:

1. It is the most preferred mode of communication for long distances.
2. The system's cost is reduced by using a single data line.

39. What are the applications of parallel and serial transmission?

Parallel Transmission

1. Parallel transmission is used by printers.
2. The data bus is used to transmit data inside the computer system, such as from the CPU to the memory and back.

Serial Transmission

1. Most long-distance communications employ serial transmission.

40. Differentiate asynchronous and synchronous transmissions

The transmitter sends data with its time clock that is unknown to the recipient in asynchronous transmission. It transfers data one byte at a time. The transmitter and receiver are both synced to the same clock frequency in synchronous transmission. Data is transmitted in blocks of several bytes.