Analog Communication Short Questions and Answers

Question 1. Define PAM and Write Down Its Drawbacks?
Answer :
Pulse Amplitude Modulation is the process by which the amplitude of the regularly spaced pulses varies according to the amplitude of the modulating signal.

The drawbacks are:

- Since the amplitude of the pulses varies therefore the peak power of the modulating signal is much greater.
- The bandwidth required for transmitting is greater since the amplitude varies.

Question 2. What is Aliasing effect? How can be Aliasing be avoided?
Answer :
Aliasing effect:
Aliasing is a signal processing term. Aliasing occurs when a system is measured at an insufficient sampling rate. In other words, aliasing occurs when you sample a signal (anything which repeats a cycle over time) too slowly (at a frequency comparable to or smaller than the signal being measured), and obtain an incorrect frequency and/or amplitude as a result.

Aliasing can be avoided if:

- Sampling frequency must be greater than the frequency of the modulating signal.
- The frequency should be band limited to maximum frequency of the signal(fm) Htz.
- If prealias filter or anti-aliasing filter is used.

Question 3. State The Advantages Of Super Heterodyning?
Answer :
The advantages are:

- High selectivity and sensitivity.
- No change in Bandwidth that is bandwidth remains same all over the operating range.
- High adjacent channel rejection.

Question 4. What Do You Mean By FM and Classify FM?
Answer :
Frequency Modulation can be defined as the frequency of the carrier is varied according to the modulating signal about an unmodulated frequency.

FM are of 2 types:

1. Narrowband FM
2. Wideband FM

Question 5. What Do You Mean By Nyquist Rate?
Answer :
The reciprocal of the Nyquist interval, i.e., the minimum theoretical sampling rate that fully describes a given signal, i.e., enables its faithful reconstruction from the samples.The actual sampling rate required to reconstruct the original signal will be somewhat higher than the Nyquist rate, because of quantization errors introduced by the sampling process.

Question 6. What Is Amplitude Modulation?
Answer :

Amplitude Modulation is defined as the process in which the instantaneous value of the amplitude of the carrier is varied according to the amplitude of the modulating or base band signal.

Question 7. What Is Modulation? What Happens In Over Modulation?

Answer :

Modulation is defined as the process in which some characteristics of the signal called carrier is varied according to the modulating or baseband signal. For example – Amplitude Modulation, Phase Modulation, Frequency Modulation.

In case of over modulation, the modulation index is greater than one and envelope distortion occurs.

Question 8. What Is Multiplexing? Name The Types Of Multiplexing?

Answer :

Multiplexing is defined as the process in which a number of message signals are combined together to form composite signals so that they can be transmitted through the common channel.

The two types of multiplexing are:

1. Frequency Division Multiplexing: In this technique, fixed frequency bands are allotted to every user in the complete channel bandwidth. Such frequency is allotted to user on a continuous basis.
2. Time Division Multiplexing: When the pulse is present for the short time duration and most of the time their is no signal present between them than this free space between the two pulses can occupied by the pulses from other channels. This is known as Time Division Multiplexing.

Question 9. What Is Sampling? What Is Sampling Theorem?

Answer :

Sampling is defined as the process in which an analog signals are converted into digital signals. It means that a continuous time signal is converted into a discrete time signal.

Sampling Theorem is defined as : 'The continuous time signal that can be represented in its samples and recovered back if the sampling frequency (fs) is greater than the maximum frequency of the signal (fm) that is fs >2fm'.

Question 10. What Is Under Sampling?

Answer :

Under sampling is also known as aliasing effect in which the sampling frequency is less than the maximum frequency of the signal and therefore the successive cycles of the spectrum overlap.

Question 11. What Is Modulation?

Answer :

Modulation may be defined as the process by which some parameters of a high frequency signal termed as carrier, is varied in accordance with the signal to be transmitted.

Question 12. What Are The Different Types Of Analog Modulation?

Answer :

1. Amplitude modulation
2. Angle modulation.

Question 13. What is the Need for Modulation?

- The amplitude is held constant thus less noise interference.
- Signal and noise separation is very easy.
- Due to constant pulse widths and amplitudes, transmission power for each pulse is same.

Question 21. What are The Application of PPM?
Answer :
PPM is employed in narrowband RF channel systems, with the position of each pulse representing the angular position of an analogue control on the transmitter, or possible states of binary switch. The number of pulse per frame gives the number of controllable channels available. The advantage of using PPM for this type of application is that the electronics required to decode the signal are extremely simple, which leads to small, lightweight receiver/decoder units. (Model aircraft require parts that are as lightweight as possible).

Question 22. Explain The Principle of PPM?
Answer :
The amplitude and the width of the pulse is kept constant in this system, while the position of each pulse, in relation to the position of a recurrent reference pulse is varied by each instantaneous sampled value of the modulating wave. This means that the transmitter must send synchronizing pulses to operate timing circuits in the receiver. The PPM has the advantage of requiring constant transmitter power output, but the disadvantage of depending on transmitter receiver synchronization.

Question 23. What is The Purpose of Ppm?
Answer :
PPM can be used to transmit analog information, such as continuous speech or data.

Question 24. What Are The Analog Analogies of PAM, PPM & PWM?
Answer :
PAM is similar to AM; PPM and PWM is similar to angle modulation.

Question 25. What is Frequency Modulation (fm)?
Answer :
Frequency modulation is the process of varying the frequency of a carrier wave in proportion to the instantaneous amplitude of the modulating signal without any variation in the amplitude of the carrier wave.

Question 26. What is PWM or Pulse Length Modulation or Pulse Duration Modulation?
Answer :
In PWM, the pulse amplitude is kept constant but the leading edge, trailing edge or both may be varied as a function of the amplitude of the sampled signal and care must be taken to ensure that the pulse don't overlap in a TDM system.

Question 27. What are The Disadvantages Of PWM?
Answer :
PWM, in general, requires a greater average power than PAM systems. Also, the PWM system requires a greater bandwidth than PAM.

Question 28. Explain The Principle Of PWM?
Answer :

Answer :
Consider, for example, picture signal of a T.V camera. It has frequency spectra of DC to 5.5MHz.such a wide band of frequency can't be propagated through ionosphere. However, if this signal is modulated with a carrier in VHF and UHF range, the percentage bandwidth becomes very small and the signal become suitable for transmission through atmosphere.

Question 14. What Are The Objectives Met By Modulation?
Answer :
Length of antenna is shortened, signal loss is reduced, ease of radiation, adjustment of bandwidth, shifting signal frequency of the assigned value.

Question 15. What Are The Advantages Of PAM & PWM?
Answer :
PWM system gives a greater signal to noise ratio as compared to PAM but requires a larger bandwidth to achieve this.

Question 16. What Is Pulse Position Modulation?
Answer :
Pulse position modulation (PPM) is the process in which the position of a standard pulse is varied as a function of the amplitude of the sampled signal.

Question 17. What is the Advantage of PPM over PWM and PAM?
Answer :
The phase deviation are usually small. The noise produces a smaller disturbing effect on the time position of the modulating pulse train and as a result, PPM waves have a better performance with respect to signal to noise ratio in comparison to PAM and PWM systems.

Question 18. What are the Applications of Pulse Position Modulation?
Answer :
It is primarily useful for optical communication systems, where there tends to be little or no multipath interference. Narrowband RF (Radio frequency) channels with low power and long wavelength (i.e., low frequency) are affected primarily by flat fading, and PPM is better suited.

Question 19. What is The Purpose Of Using Differential Pulse Position Modulation?
Answer :
It is possible to limit the propagation of errors to adjacent symbols, so that an error in measuring the differential delay of one pulse will affect only two symbols, instead of effecting all successive measurements.

Question 20. What Are The Advantage Of Ppm?
Answer :
One of the principle advantages of pulse position modulation is that it is an Mary modulation technique that can be implemented no coherently, such that the receiver does not need to use a phase locked loop (PLL) to track the phase of the carrier.

This makes it a suitable candidate for optical communications systems, where coherent phase modulation and detecting are difficult and extremely expensive. The only other common Mary non-coherent modulation technique is Maryfrequency shift keying, which is the frequency domain dual to PPM.The other advantages of pulse position modulation are:

Pulse width modulation (PWM) of a signal or power source involves the modulation of its duty cycle, to either convey information over a communication channel or control the amount of power sent to a load. PWM uses a square wave whose pulse width is modulated resulting in the variation of the average value of the waveform is directly dependent on the duty cycle D.

Question 29. Mention The Applications of PWM?
Answer :
PWM can be used to reduce the total amount of power delivered to a load without losses normally incurred when a power source is limited by resistive means. This is because the average power delivered is proportional to the modulation duty cycle. With a sufficiently high modulation rate, passive electronic filters can be used to smooth the pulse train and recover an average analog waveform.

What is a Phase-Locked Loop?

Phase Locked Loop **(PLL)** is one of the vital blocks in linear systems. It is useful in communication systems such as radars, satellites, FMs, etc.

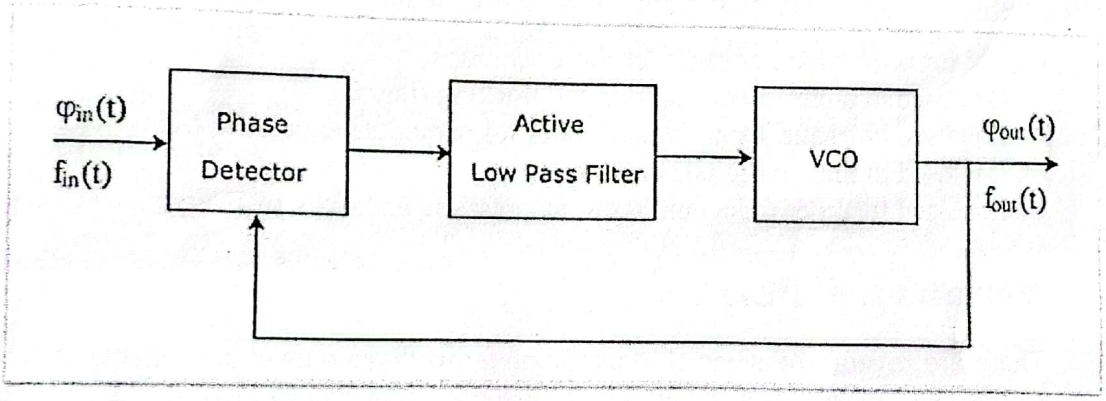
This chapter discusses about the block diagram of PLL and IC 565 in detail.

Block Diagram of PLL

A Phase Locked Loop (PLL) mainly consists of the following **three blocks –**

- Phase Detector
- Active Low Pass Filter
- Voltage Controlled Oscillator (VCO)

The **block diagram** of PLL is shown in the following figure –



The output of a phase detector is applied as an input of active low pass filter. Similarly, the output of active low pass filter is applied as an input of VCO.

The **working** of a PLL is as follows –

- **Phase detector** produces a DC voltage, which is proportional to the phase difference between the input signal having frequency of finfin and feedback (output) signal having frequency of foutfout.
- A **Phase detector** is a multiplier and it produces two frequency components at its output – sum of the frequencies finfin and foutfout and difference of frequencies finfin & foutfout.
- An **active low pass filter** produces a DC voltage at its output, after eliminating high frequency component present in the output of the phase detector. It also amplifies the signal.
- A **VCO** produces a signal having a certain frequency, when there is no input applied to it. This frequency can be shifted to either side by applying a DC voltage to it. Therefore, the frequency deviation is directly proportional to the DC voltage present at the output of a low pass filter.

The above operations take place until the VCO frequency equals to the input signal frequency. Based on the type of application, we can use either the output of active

low pass filter or output of a VCO. PLLs are used in many **applications** such as FM demodulator, clock generator etc.

PLL operates in one of the **following three modes –**

- Free running mode
- Capture mode
- Lock mode

Initially, PLL operates in **free running mode** when no input is applied to it. When an input signal having some frequency is applied to PLL, then the output signal frequency of VCO will start change. At this stage, the PLL is said to be operating in the **capture mode**. The output signal frequency of VCO will change continuously until it is equal to the input signal frequency. Now, it is said to be PLL is operating in the **lock mode**.

Applications of Phase-Locked Loop

- FM demodulation networks for FM operations
- It is used in motor speed controls and tracking filters.
- It is used in frequency shifting decodes for demodulation carrier frequencies.
- It is used in time to digital converters.
- It is used for Jitter reduction, skew suppression, and clock recovery.

Variations of PLL

There are several variations of PLLs. Some terms that are used are "analog phase-locked loop" (APLL), also referred to as a linear phase-locked loop" (LPLL), "digital phase-locked loop" (DPLL), "all digital phase-locked loop" (ADPLL), and "software phase-locked loop" (SPLL).

Analog or linear PLL (APLL)

Phase detector is an analog multiplier. Loop filter is active or passive. Uses a voltage-controlled oscillator (VCO). APLL is said to be a type II if its loop filter has transfer function with exactly one pole at the origin (see also Egan's conjecture on the pull-in range of type II APLL).

Digital PLL (DPLL)

An analog PLL with a digital phase detector (such as XOR, edge-trigger JK, phase frequency detector). May have digital divider in the loop.

All digital PLL (ADPLL)

Phase detector, filter and oscillator are digital. Uses a numerically controlled oscillator (NCO).

Software PLL (SPLL)

Functional blocks are implemented by software rather than specialized hardware.

Charge-pump PLL (CP-PLL)

CP-PLL is a modification of phase-locked loops with phase-frequency detector and square waveform signals. See also Gardner's conjecture on CP-PLL.

Performance parameters

- Type and order.
- Frequency ranges: hold-in range (tracking range), pull-in range (capture range, acquisition range), lock-in range.[11] See also Gardner's problem on the lock-in range, Egan's conjecture on the pull-in range of type II APLL.
- Loop bandwidth: Defining the speed of the control loop.
- Transient response: Like overshoot and settling time to a certain accuracy (like 50 ppm).
- Steady-state errors: Like remaining phase or timing error.
- Output spectrum purity: Like sidebands generated from a certain VCO tuning voltage ripple.
- Phase-noise: Defined by noise energy in a certain frequency band (like 10 kHz offset from carrier). Highly dependent on VCO phase-noise, PLL bandwidth, etc.
- General parameters: Such as power consumption, supply voltage range, output amplitude, etc.