

1. Define modulation?

Modulation is a process by which some characteristics of high frequency carrier signal is varied in accordance with the instantaneous value of the modulating signal.

2. What are the types of analog modulation?

(i) Amplitude modulation.

(ii) Angle Modulation

1. Frequency modulation 2. Phase modulation.

3. Define the term modulation index for AM.

Modulation index is the ratio of amplitude of modulating signal (E_m) to amplitude of carrier (E_c) i.e. $m = \frac{E_m}{E_c}$

4. What are the degrees of modulation?

a) Under modulation ($m < 1$) b) Critical modulation ($m=1$)

c) Over modulation ($m>1$)

5. What is the need for modulation?

Needs for modulation:

a)

b) c)

d) e) f)

Ease of transmission

Multiplexing

Reduced noise

Narrow bandwidth

Frequency assignment

Reduce the equipments limitations.

6. Give the Classification of Modulation.

There are two types of modulation. They are a) Analog modulation

b) Digital modulation

Analog modulation is classified as follows

(i) Continuous wave modulation

(ii) Pulse modulation

Continuous wave modulation is classified as follows

(i) Amplitude modulation

(ii) Double side band suppressed carrier

(iii) Single side band suppressed carrier

(iv) Vestigial side band suppressed carrier

Angle modulation

(i) Frequency modulation

ii) Phase modulation

Pulse modulation is classified as follows

(i) Pulse amplitude modulation (ii) Pulse position modulation

(iii) Pulse duration modulation

(iv) Pulse code modulation

Digital modulation is classified as follows

(i) Amplitude shift keying

(ii) Phase shift keying (iii) Frequency shift keying

7. What is the difference between high level and low level modulation?

In high level modulation, the modulator amplifier operates at high power levels and delivers power directly to the antenna. In low level modulation, the modulator amplifier performs modulation at relatively low power levels. The modulated signal is then amplified to high power level by class B power amplifier. The amplifier feeds power to antenna.

8. Define Detection.

Detection is the process of extracting modulating signal from the modulated carrier. Different types of detectors are used for different types of modulations.

9. Define Amplitude Modulation.

In amplitude modulation, the amplitude of a carrier signal is varied according to variations in amplitude of modulating signal.

The AM signal can be represented mathematically as, $e_{AM} = (E_c + E_m \sin \omega_m t) \sin \omega_c t$ and the modulation index is given as, $m = E_m / E_c$

10. What is Super Heterodyne Receiver?

The super heterodyne receiver converts all incoming RF frequencies to a fixed lower frequency, called intermediate frequency (IF). This IF is then amplified and detected to get the original signal.

11. What is single tone and multi tone modulation?

If modulation is performed for a message signal with more than one frequency component then the modulation is called multi tone modulation.

If modulation is performed for a message signal with one frequency component then the modulation is called single tone modulation.

12. Compare AM with DSB-SC and SSB-SC.

S.No AM DSB-SC SSB-SC

1 Bandwidth = $2f_m$ Bandwidth = $2f_m$ Bandwidth = f_m

2 Contains USB, LSB, Carrier Contains USB, LSB USB, LSB

3 More Power is required for transmission than that of AM. Power required is less than AM. Power required is less than AM.

AM & DSB-SC

13. What are the advantages of VSB-AM?

1. It has bandwidth greater than SSB but less than DSB system.
2. Power transmission greater than DSB but less than SSB system.
3. No low frequency component lost. Hence it avoids phase distortion.

14. How will you generate DSBSC-AM?

There are two ways of generating DSBSC-AM such as a). Balanced modulator
b). Ring modulators

15. What are advantages of ring modulator?

- a). Its output is stable.
- b). It requires no external power source to activate the diodes.
- c). Virtually no maintenance.
- d). Long life.

Define Demodulation.

Demodulation or detection is the process by which modulating voltage is recovered

from the modulated signal. It is the reverse process of modulation. The devices used for demodulation or detection are called demodulators or detectors. For amplitude modulation,

detectors or demodulators are categorized as,

- a) Square-law detectors
- b) Envelope detectors

17. Define Multiplexing.

Multiplexing is defined as the process of transmitting several message signals Simultaneously over a single channel.

18. Define Frequency Division Multiplexing.

Frequency division multiplexing is defined as many signals are transmitted simultaneously with each signal occupying a different frequency slot within a common bandwidth.

19. Define Guard Band.

Guard Bands are introduced in the spectrum of FDM in order to avoid any interference between the adjacent channels. Wider the guard bands, Smaller the interference.

20. Define SSB-SC.

- (i) SSB-SC stands for Single Side Band Suppressed Carrier
- (ii) When only one sideband is transmitted, the modulation is referred to as Single side band modulation. It is also called as SSB or SSB-SC.

21. Define DSB-SC.

After modulation, the process of transmitting the sidebands (USB, LSB) alone and suppressing the carrier is called as Double Side Band-Suppressed Carrier.

22. What are the disadvantages of DSB-FC?

- (i) Power wastage takes place in DSB-FC
- (ii) DSB-FC is bandwidth inefficient system.

23. Define Coherent Detection.

During Demodulation carrier is exactly coherent or synchronized in both the frequency and phase, with the original carrier wave used to generate the DSB-SC wave. This method of detection is called as coherent detection or synchronous detection.

24. What is Vestigial Side Band Modulation?

Vestigial Sideband Modulation is defined as a modulation in which one of the sideband is partially suppressed and the vestige of the other sideband is transmitted to compensate for that suppression.

25. What are the advantages of signal sideband transmission?

- a) Power consumption
- b) Bandwidth conservation
- c) Noise reduction

26. What are the disadvantages of single side band transmission?

- a) Complex receivers: Single side band systems require more complex and expensive receivers than conventional AM transmission.
- b) Tuning difficulties: Single side band receivers

require more complex and precise tuning than conventional AM receivers

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27. Compare linear and non-linear modulators?

S.No Linear Modulators Non Linear Modulators
 1. Heavy filtering is not required. Heavy filtering is required.

2. These modulators are used in high level modulation. These modulators are used in low level modulation.

The carrier voltage is very much The modulating signal voltage is very much

3. greater than modulating signal greater than the carrier signal voltage. voltage.

28. What is frequency translation?

Suppose that a signal is band limited to the frequency range extending from a frequency f_1 to a frequency f_2 . The process of frequency translation is one in which the original signal is replaced with a new signal whose spectral range extends from f_1' and f_2' and which new signal bears, in recoverable form the same information as was borne by the original signal.

29. What are the two situations identified in frequency translations?

a) Up Conversion: In this case the translated carrier frequency is greater than the incoming carrier

b) Down Conversion: In this case the translated carrier frequency is smaller than the increasing carrier frequency.

Thus, a narrowband FM signal requires essentially the same transmission bandwidth as the AM signal.

30. What is BW for AM wave?

The difference between these two extreme frequencies is equal to the bandwidth of the AM wave.

Therefore, Bandwidth, $B = (f_c + f_m) - (f_c - f_m)$ $B = 2f_m$

31. What is the BW of DSB-SC signal?

Bandwidth, $B = (f_c + f_m) - (f_c - f_m)$ $B = 2f_m$

It is obvious that the bandwidth of DSB-SC modulation is same as that of general AM waves.

32. What are the demodulation methods for DSB-SC signals?

The DSB-SC signal may be demodulated by following two methods: (i) Synchronous detection method.

(ii) Using envelope detector after carrier reinsertion.

33. Write the applications of Hilbert transform?

(i) For generation of SSB signals,

(ii) For designing of minimum phase type filters, (iii) For representation of band pass signals.

34. What are the methods for generating SSB-SC signal?

SSB-SC signals may be generated by two methods as under:

(i) Frequency discrimination method or filter method. (ii) Phase discrimination method or phase-shift method.