UNIT IV

NOISE SOURCES AND TYPES

1. Define Noise.

Noise is an **unwanted signal**, which interferes with the original message signal and corrupts the parameters of the message signal. This alteration in the communication process, leads to the message getting altered. It most likely enters at the channel or the receiver.

2. What is mean by External Noise?

This noise is produced by the external sources, which may occur in the medium or channel of communication usually. This noise cannot be completely eliminated. The best way is to avoid the noise from affecting the signal.

3. List the types of External Noises.

- Atmospheric noise (due to irregularities in the atmosphere).
- Extra-terrestrial noise, such as solar noise and cosmic noise.
- Industrial noise.

4. What is mean by Internal Noise?

This noise is produced by the receiver components while functioning. The components in the circuits, due to continuous functioning, may produce few types of noise. This noise is quantifiable. A proper receiver design may lower the effect of this internal noise.

5. Write most common examples of internal noises.

- Thermal agitation noise (Johnson noise or Electrical noise)
- Shot noise (due to the random movement of electrons and holes)
- Transit-time noise (during transition)
- Miscellaneous noise is another type of noise which includes flicker, resistance effect and mixer generated noise, etc.

6. What are the Effects of Noise?

Noise limits the operating range of the systems:

Noise indirectly places a limit on the weakest signal that can be amplified by an amplifier. T he oscillator in the mixer circuit may limit its frequency because of noise. A system's operation depends on the operation of its circuits. Noise limits the smallest signal that a receiver is capable of processing.

Noise affects the sensitivity of receivers:

Sensitivity is the minimum amount of input signal necessary to obtain the specified quality output. Noise affects the sensitivity of a receiver system, which eventually affects the output.

7. **Define Signal to Noise Ratio.**

   Signal-to-Noise Ratio (SNR) is the ratio of the signal power to noise power. The higher the value of SNR, the greater will be the quality of the received output.

8. **Define Figure of Merit.**

   The ratio of output Signal to Noise Ratio and input Signal to Noise Ratio can be termed as Figure of Merit. It is denoted by F.

9. **Write the formula for Figure of Merit for AM system.**

$$F = \frac{(SNR)_{O,AM}}{(SNR)_{C,AM}}$$

$$\Rightarrow F = \left(\frac{A_c^2 k_a^2 P}{2WN_0}\right) / \left(\frac{{A_c}^2 (1 + {k_a}^2) P}{2WN_0}\right)$$

$$\Rightarrow F = \frac{{K_a}^2 P}{1 + {K_a}^2 P}$$

Therefore, the Figure of merit of AM receiver is less than one.

10. **Write the formula for Figure of Merit for DSBSC system.**

$$F = \frac{(SNR)_{O,DSBSC}}{(SNR)_{C,DSBSC}}$$

$$\Rightarrow F = \left(\frac{{A_c}^2 P}{2WN_0}\right) / \left(\frac{{A_c}^2 P}{2WN_0}\right)$$

$$\Rightarrow F = 1$$

Therefore, the Figure of merit of DSBSC receiver is 1.

11. **Write the formula for Figure of Merit for SSBSC system.**

$$F = \frac{(SNR)_{O,SSBSC}}{(SNR)_{C,SSBSC}}$$

$$F = \left(\frac{{A_m}^2 {A_c}^2}{8WN_0}\right) / \left(\frac{{A_m}^2 {A_c}^2}{8WN_0}\right)$$

$$F = 1$$

Therefore, the Figure of merit of SSBSC receiver is 1.

12. **Write the formula for Figure of Merit for FM system.**

$$(FOM)_{FM} = 3\frac{k_f^2 P_M}{W^2} = \frac{3}{4}\left[\frac{(B_{rms})_{FM}}{W}\right]^2$$

13. **Define Noise Factor.**

    The noise factor can be derived simply by taking the SNR at the input and dividing it by the SNR at the output. As the SNR at the output will always be worse, i.e. lower, this means that the noise factor is always greater than one. The noise factor is rarely seen in specifications.

14. **Define Noise Figure.**

    Noise figure is the parameter that is seen widely in specifications and in use when defining radio receivers and the elements within the receiver systems. The noise figure uses a logarithmic scale and is simply the noise factor expressed in decibels

15. How to measure Noise figure?

The noise figure of an element used in a radio system can be measured in a two ways.

- Noise figure measurement meter
- Spectrum analyzer noise figure measurement

16. Write formula for Equivalent Noise Temperature.

$$T_n = T_o (F-1)$$

17. Write formula for Equivalent Noise Temperature for Cascaded Stages.

$$T_{eq} = T_1 + \frac{T_2}{G_1} + \frac{T_3}{G_1 G_2} + \cdots$$

18. Define Equivalent Noise Bandwidth.

A filter's equivalent noise bandwidth (ENBW) is defined as the bandwidth of a perfect rectangular filter that passes the same amount of power as the cumulative bandwidth of the channel selective filters in the receiver.

19. What is Thermal Noise?

The Thermal Noise or White Noise or Johnson noise is the Random Noise which is generated in a resistor or the resistive component of complex impedance due to rapid and random motion of the molecules, atoms and electrons in a conductor.

20. Define Man made Noise or Industrial Noise.

The Industrial Noise is the type of noise which is produced by sources such as automobiles and aircraft ignition, electrical motors, switch gears and leakage from high voltage transmission lines