NOISE IN COMMUNICATION SYSTEMS

Communication noise refers to **influences on effective communication that influence the interpretation of conversations**

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 is most likely to be entered at the channel or the receiver.

The slam of a door, the slap of a hand on a table, or the clap of a hand are all examples of one-impulse sounds. Sounds such as a telephone ringing, birds chirping, sirens, or a computer humming are also examples.

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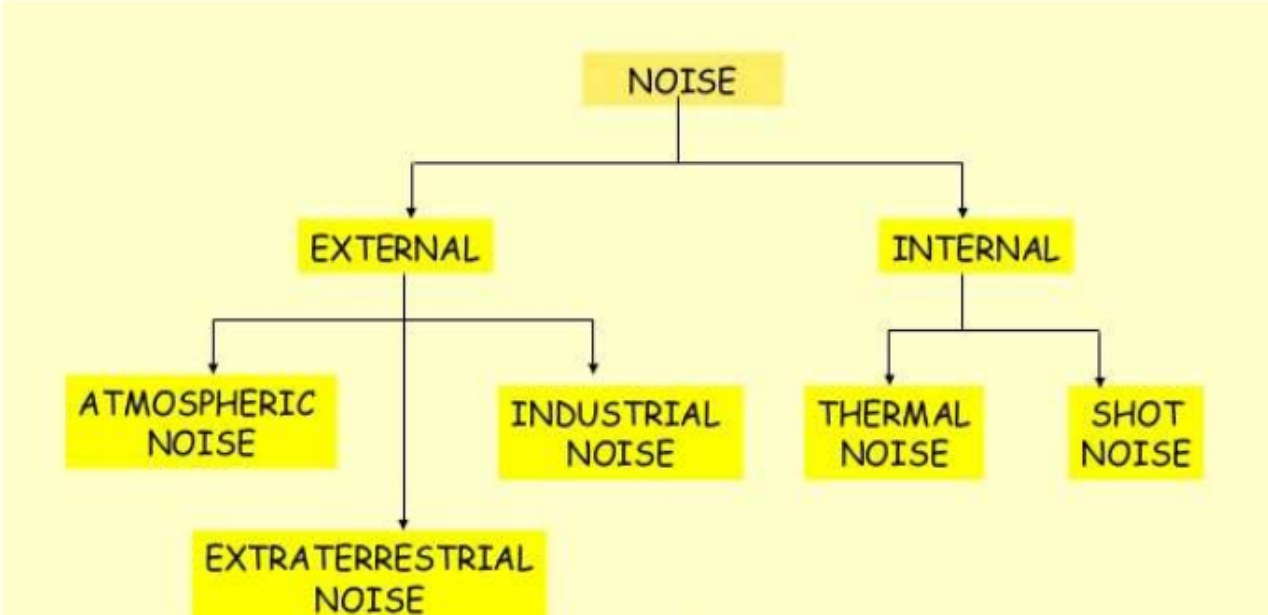
Noise: It is an unwanted signal which tends to interfere with the modulating signal.

Types of noise:

Noise is basically divided into,

1. External Noise
2. Internal Noise



Classification of Noise

1.External Noise:

- **Atmospheric Noise**: Radio noise caused by natural atmospheric processes, primarily lightening discharges in thunder storms.
- **Extraterrestrial Noise**: Radio disturbances from sources other than those related to the Earth.

  Cosmic Noise: Random noise that originates outside the Earth's atmosphere.

  Solar Noise: Noise that originates from the Sun is called Solar noise.

Classification of Noise

- **Industrial Noise**: Noise generated by automobile ignition, aircrafts, electric motors, Switch gears, welding etc.

2. **Internal Noise**:

- **Shot Noise**: Random motion of electrons in the semiconductor devices generates shot noise.
- **Thermal or Johnson's Noise**: Random motion of electrons in the resistor is called Thermal noise.

$$V_n = KT_0BR$$

Where, K= Boltzmann constant, R= Resistance

T_0= Absolute temperature B= Bandwidth

Noise Parameters

Signal-to-Noise Ratio

In terms of definition, SNR or signal-to-noise ratio is the ratio between the desired information or the power of a signal and the undesired signal or the power of the background noise.

SNR is a measure used in science and engineering that compares the level of a desired signal to the level of background noise.

SNR is an important parameter that affects the performance and quality of systems that process or transmit signals, such as communication systems, audio systems, radar systems, imaging systems, and data acquisition systems.

Signal-to-noise ratio is defined as the ratio of the power of a signal (meaningful input) to the power of background noise (meaningless or unwanted input):

$$\mathrm{SNR} = \frac{P_{\mathrm{signal}}}{P_{\mathrm{noise}}},$$

Noise Figure (NF)

The noise figure is defined as the ratio of the output signal-to-noise power ratio (SNR) to the input SNR, and it is expressed in dB. A lower noise figure indicates that less noise is added to the signal by the amplifier, resulting in a higher signal quality.

Noise Factor (F)

Noise Factor is the measure of degradation of the signal to noise ratio in a device. It is the ratio of the Signal to Noise Ratio at the input to the Signal to Noise Ratio at the output.

$$F = \frac{\mathrm{SNR_i}}{\mathrm{SNR_o}}$$

where $\mathrm{SNR_i}$ and $\mathrm{SNR_o}$ are the input and output signal-to-noise ratios respectively. The SNR quantities are unitless power ratios. The noise figure NF is defined as the noise factor in units of decibels (dB):

$$\mathrm{NF} = 10\log_{10}(F) = 10\log_{10}\left(\frac{\mathrm{SNR_i}}{\mathrm{SNR_o}}\right) = \mathrm{SNR_{i,\ dB}} - \mathrm{SNR_{o,\ dB}}$$

where $\mathrm{SNR_{i,\ dB}}$ and $\mathrm{SNR_{o,\ dB}}$ are in units of (dB). These formulae are only valid when the input termination is at standard noise temperature $T_0 = 290\ \mathrm{K}$, although in practice small differences in temperature do not significantly affect the values.