NOISE AND ITS EFFECTS IN COMMUNICATION SYSTEM

In any communication system, during the transmission of the signal, or while receiving the signal, some unwanted signal gets introduced into the communication, making it unpleasant for the receiver, questioning the quality of the communication. Such a disturbance is called as noise.

- Noise is random in nature.
- Noise degrade the level of quality of the received signal at the receiver.
- Due to the presence of noise efficiency of communication system reduces.

Types of Noise

The classification of noise is done depending on the type of the source, the effect it shows or the relation it has with the receiver, etc. There are two main ways in which noise is produced. One is through some external source while the other is created by an internal source, within the receiver section.

External source

Natural Noise

Natural noise gets generated due to either natural phenomenon or atmospheric actions like solar flares, radiation in space, electronic storms etc.

It is further classified into atmospheric and extraterrestrial noise.

Atmospheric Noise

The atmospheric actions produce false or spurious signals that get added with the original signal thereby causing interference in the information signal. These spurious signals propagate in the same manner as the original signal.

Hence the receiver at the other end collects both message as well as spurious signals.

Extraterrestrial Noise

This type of noise is generated by either the sun or the outer space. This type of noise is classified into two categories:

Solar Noise: Solar noise is generated by the sun. As Sun is a large body with extremely high temperature thus it emits or releases high electrical energy in noise form over a broad frequency range.
However, the intensity of the produced noise signal changes timely. This is so because the temperature change of the sun follows 11 years of the life cycle. Hence large electrical disturbances occur after the period of every 11 years. While at other years the noise level is comparatively low.

Cosmic Noise: This noise originates from the stars present in the outer space. As distant stars are also very high-temperature bodies and are also termed as the sun. The noise generated from the star is similar to that generated from the sun. Cosmic noise is also known as **black body noise**.
Not only the stars but the galaxies and other virtual point sources like **quasars** and **pulsars** in the outer space produces cosmic noise.

Man-made noise

This type of extrinsic noise is also known as industrial noise. These are basically the electrical noise that gets produced by the wear and tear of the circuit being used. The source of man-made noise is electric motors, high current circuits, florescent lights switch gears etc.

When these machines operate, arc discharge takes place and this discharge generates noise signals in the communication system.

The frequency spectrum of man-made noise lies between **1 MHz** to **600 MHz**.
2 ***Internal Noise*** is the fundamental noise that gets generated by the electronic equipment involved in the system itself. They are called so because these are nothing but an integral part of the system.
Proper designing of the communication system can reduce or overcome noise due to internal sources.

Internal Noise is classified as follows:

Thermal Noise

As we already know that an electrical signal is transmitted through a channel by the help of conductors. So, the electrons present in the conductors move randomly.

The random motion of the electrons is the reason for the thermal energy received by the conductor. However, these free electrons are non-uniformly distributed within the conductor.

Due to this a possibility also exist that at one end the number of free electrons will be comparatively higher than at the other end.

This non-uniform distribution of electrons provides the average voltage to be zero, however, the average power is not zero in this case.

So, this non zero power is nothing but the noise. And as it is the outcome of thermal action. Hence also known as thermal noise power. Thermal noise is sometimes referred as **Johnson noise** or **white noise**.

Shot Noise

Shot noise in a communication channel is the result of random variation in the appearance of electrons and holes at the output side of the device. These random movements are the result of discontinuities in the device which is being used by the system.

The shot noise generates sound like several lead shots are striking over a metal plate or tube.

It also occurs in pn junction diodes, as though movement of carriers within the diode is due to the action of an external potential. But, sometimes their random movement generates shot noise.

Thus we can say non-linearity or discontinuity in the system generates shot noise.

Partition Noise

Here the name itself is indicating the cause for generation of this type of noise.

As it gets generated when the system is composed of multiple paths, and during the flow, the current gets divided in these paths. These are nothing but the result of random variation in the divisions. Due to this reason some devices offer low partition noise while some offers, high.

Flicker Noise

It is also known as low-frequency noise and it occurs because of the variation in the carrier density. Due to this variation or fluctuation, the conductivity of the material gets varied.

So, when a direct current is allowed to flow through the conductor then fluctuating voltage drop across in the conductor results in flicker noise voltage.

It is to be noteworthy here that, **the mean square of flicker noise voltage is directly proportional to the square of the current** flowing through the device.

Transit Time Noise

It is also known as high-frequency noise. It arises when the charge carriers require comparatively more time to travel from one end to another within the conductor. This effect is called **transit time effect**.

For low-frequency applications, this effect is avoidable but for high-frequency applications the effect is unavoidable. Due to this transit time effect, random noise gets generated inside the device and is known as transit time noise.