SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

IYEAR/ II SEMESTER

23ECT101 Basics of Electrical Engineering and Instrumentation

TOPIC -**CHARACTERISTICS OF MEASUREMENT SYSTEM**

STATIC & DYNAMIC CHARACTERISTICS OF MEASUREMENT SYSTEM

The performance characteristics of an instrument are mainly divided into two categories:

i) Static characteristics

ii) Dynamic characteristics

Static characteristics:

The set of criteria defined for the instruments, which are used to measure the quantities which are slowly varying with time or mostly constant, i.e., do not vary with time, is called '**static characteristics'**

The various static characteristics are:

1)Accuracy
2) Precision
3) Sensitivity
4) Linearity
5) Reproducibility
6) Repeatability
7) Resolution
8) Threshold
9) Drift
10) Stability
11)Tolerance
12)Range or span
13)Static Error
14)Dead zone

Accuracy:

It is the degree of closeness with which the reading approaches the true value of the quantity to be measured.

Precision: refers to the closeness of two or more measurements to each other. Using the example above, if you weigh a given substance five times, and get 3.2 kg each time, then your measurement is very precise. Precision is independent of accuracy. You can be very precise but inaccurate

Sensitivity:

It is defined as the ratio of the changes in the output of an instrument to a change in the value of the quantity being measured. It denotes the smallest change in the measured variable to which the instrument responds.

Linearity: A system is said to be linear if proportional changes in input measurements produce proportional changes in output measurement Linearity is an indicator of the consistency of measurements over the entire range of measurements

Reproducibility- refers to the consistency of measurements. It is the extent to which a tool can produce the same result when used repeatedly under the same circumstances.

Repeteability: It defines how consistent is the output of an instrument for the same input tried again and again under the same conditions

Resolution: Resolution (MSA) is the ability of the measurement system to detect and faithfully indicate small changes in the characteristic of the measurement result

Range: The left extreme and right extreme values of a quantity for which the instrument is designed to function. The range is equal to Maximum value minus minimum value.

Tolerance: It is the highest allowable error that is specified in terms of certain values while measurement, it is called tolerance.

Threshold: If the instrument input is increased very gradually from zero there will be some minimum value below which no output change can be detected. This minimum value defines the threshold of the instrument.

Drift: All calibrations and specifications of an instrument are only valid under controlled conditions of pressure, temperature, etc. As variations occur in ambient temperature, etc. certain static characteristics change. Such environmental conditions affect the output and the instrument and can be called as **Drift.**

Stability -refers the ability of a measurement system produce the same values over time while measuring the same sample.

Static Error

Static Error is the variation between the true values of a measurable quantity to the values indicated by the measuring instrument which are not affected by operating conditions.

Static error = True value of a measured quantity – Indicated Value.

If the Static error is +ve, it means the instrument reads a high value.

If the Static error is -ve, it means the instrument reads a low value.

Dead Zone

For the largest range of values of a measured variable, to which the instrument does not respond.

Dynamic Characteristics of an Instrument

Some of the dynamic characteristics of instruments are **Dynamic Error, Response Speed, Fidelity, Lag, Retardation Lag, and Time Delay Lag**

Dynamic Error

Dynamic Error is the variation between the true values of a measurable quantity to the values indicated by the measuring instrument which are affected by operating conditions.

Response Speed

Response Speed is defined as the rapidity of the instrument to responds to the changes in the measuring variable.
It indicates how active and fast the system is.

Fidelity

Fidelity is defined as the degree to which a measuring instrument reproduces change in input faithfully without any dynamic error

Lag

The lag time is taken by the system to respond, since every instrument takes at least some time to respond, whatever time it may be to the changes in the measured variable.

Retardation Lag

The response of the measurement begins immediately after the change in measured quantity has occurred.

Time Delay Lag

In this case, after the application of input, the response of the measurement system begins with some dead times.