Performance characteristic of Instrument :—

The problem with any measuring instrument is error. Hence it is necessary to select the appropriate instrument and measuring processor which minimize the error.

- Static characteristic
  - Accuracy
  - Resolution
  - precision
  - expected Value
  - error
  - sensitivity
- dynamic characteristic
  - speed of response
  - fedility
  - Lag
  - Dyromic Error

Static characteristic :—

It is defined for the Instrument used to measure the Quantity which is independent of time.

Accuracy :—

The degree of closeness of measured Quantity to the true value is known as accuracy

At = 5V → True value

Am = 4.2V → Measured volue

4.8V

4.99V → More accuracy

3.5V → Least accuracy

Resolution :—

It is the smallest observable change in Input then the instrument Can response is called resolution.

Ex:— If I/p is = 1V then o/p is = 2V

1.1V (0.2V) 2V

1.2V 2.5

1.3V (0.2V) 2.5

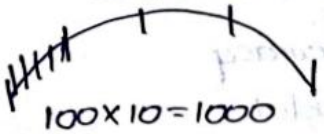
1.4V 3V

Here the observable change is 0.2V hence the resolution is 0.2V

$$R = \frac{\text{full scale scale Voltage}}{\text{total no: of divisions.}}$$

→ A Zero (0) to 10V voltmeter with number of division's of divisions of 100 and we can estimate 1/10th of the scale divison very accurately?

$$R = \frac{10}{1000} = 0.01$$



Precision:—

The Most repetable Value or reproducable value among a set of records is called precision.

Ex:— $A_t = 10V$

A_m = 9.1V, 9.2, 9.3, 9.4, 9.5 → low precision, low accuracy

9.9V, 9.9, 9.9, 9.7, 9.6 → high precision, high accuracy

9.1, 9.2, 9.2, 9.2, 9.6 → low accuracy, high accuracy

$$P = 1 - \left| \frac{x_n - \bar{x}_n}{\bar{x}_n} \right|$$

P - precision

x_n - n^{th} Value of measurment

$\bar{x}_n$ - Average set of recorded

Precision is supporting characteristic of accuracy.

The accurate instruments may be precises but precises will not Conform any Accuracy.

Expected Value:-

The Most probable Value that calculation one should expect to measure.

The difference of Measured value to the true value is known as error

$$E = A_m - A_t$$

$E \rightarrow$ error

$A_m \rightarrow$ Measure value, $A_t \rightarrow$ true value

E is +ve when Am > At

E is -ve when Am < At

Ex:- $A_t = 5V$

$A_m = 4.5$

$E = -0.5V$

We have to add or subtract some Quantity to the measured value inorder to get the true value is called as Correction factor (C_f)

If error +ve then C_f is -ve

If error -ve then C_f is +ve

Sensitivity:- It is defined as ratio of magnitude of output signal to magnitude of i/p signal.

$$S = \frac{\text{mag of o/p signal}}{\text{mag of i/p signal}}$$

When a small change in i/p will effect a large change in o/p signal, then the Instrument is called high sensitivity instrument

→ We always prefer high sensitivity instrument then we may note loose any accuracy

→ Sensitivity can also be expressed as

$$S = \frac{\Omega}{V}$$

$$S = 1/V/\Omega$$

$$S = \frac{1}{I_{fsd}}$$ fsd:- full scale deflection Current

Sensitivity ↑ → loading error ↓ → Accuracy ↑