Lec 6

Measurement and instruction:

Measurement: A method to information regarding the physical value of the variable.

Instrumentation: Process of acquiring data about one or more physical quantities of interest using electrical sensors and instruments.

Calibration: Implies that there is a numeric relationship throughout the whole instrumentation system

Application

Home: → Thermometer, watch, Barometer

Vehicles → Speedometer, fuel gauge

Industry → Automation, process control, Boiler controll

Why We need to measurement/necessity of measurement.

Why

monitor | Control | Analysis.

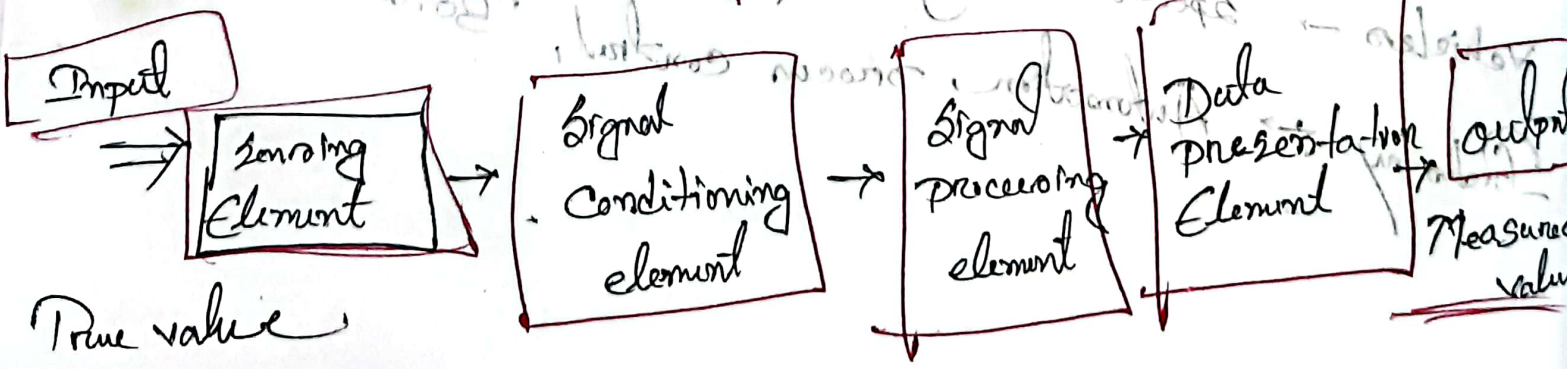
Example: in case of process industries and industrial manufacturing.

- To improve the quality of the product
- " " " efficiency
- " maintain the proper operation.

measurement is also required to get/aquire data or information about parameters. In terms of

- putting the numerical values to the physical quantities.
- Making measurement otherwise incredible
- producing data agreeable to analysis

Generalized Measuring System.



Stage 1 . A detection → transducer or sensor

Ex - Thermocouple

Stage 2 : A signal conditioning stage

Ex : Amplifier, filters, Bridges.

Stage 3 : A signal processing stage

Ex : ADC , Computer.

stage 4 : read out stage — recording stage.

Ex ; Printer, Oscilloscope

Types of measuring instrument :

Null type instrument : A Zero or Null induction leads to determination of the magnitude of measured quantity.

Ex : DC - Potentiometer .

Absolute instruments : It give the quantity to be measured in term of instruments physical constant . Ex : Tangent Galvanometer .

এখানে physical constant যেমন, বিভিন্ন

↳ the angle, deflection degree constant

Secondary Instruments: where the deflection (or) control gives the magnitude of electrical quantity to be measured directly

Ex: Voltmeter, Thermometer

Active Instrument: The quantity being measured simply modulates the magnitude of some external power source. modified

Ex: Float type petrol

Passive Instrument: passive instrument output is complete produced by the quantity being measured

Ex: pressure measuring device

Digital instrument: It have only finite number of values and varies discrete steps.

Ex: Revolution Counter

Error

It is the Difference between measured value and the actual value.

Types of error in Measurement

- Static error
  - Random
    - occours due to unknown causes which difficult to determine
  - Systematic
    - Observational
    - Environmental
    - Instrumental
      - Inherent limitation device
      - Abuse of Apparatus
      - Effect of loading
  - Gross
    - occours due to human mistakes, or taking wrong readings.

Systematic error : 3 types are
- observational
- Instrumental
- Environmental.

It is occours due to the lack of the quality in measuring instruments such as defective equipments.

Types of systematic error

observational : It is occurs due to design and construction-onal features or the mechanical structure of the instruments

Environmental : It is occours due to the temperature pressure, force, moisture etc.

Observational : It is occour due to observation

It is happen due to this reasons.

- Inherent limitations
- Abuse Apparatus
- Effet of loading

Accuracy	vs	precision
• Closeness of measurement of the true value.		• Repeatability of measurement.
True = 25mm, measured = 25.01mm		True = 25mm. measured · 25.5, 25.49, 25.51.
• It is affected with systematic error		• It is affected with random error
• It can be determined by single measurement but some error		• It is determined precision several measurement are needed
• Accuracy can be improved		• It can't be improved.
Factor Selection: where measurement are made doesn't alter the circuit condition.		

Mechanical loading:

- It is the physical stress on a mechanical system
- Load can be static or dynamic
- Some loads specified part of the design of mechanical system
- Some mechanical Loads can be measured by an appropriate test method in Lab.

Impedance Matching It is make sure that the input impedance of one stages, called source, is equal the output impedance of the following stages called load

It helps:

- Transfer maximum power to the network or load
- Improve the signal to noise ratio of the system
- Matching network is ideally lossless.

Special Transformer called impedance matching
Which can used to match impedance