

## UNIT I- Concept of Measurements

2 MARKS

1. What is Range of measurement?

The physical variable that is measured between two values is called as a range. One is the higher calibration value H, and the other is Lower value L, The difference between H, and L, is called range.

2. What is Resolution?

The minimum value of the input signal is required to cause an appreciable change in the output known as resolution.

3. Differentiate between sensitivity and range with suitable example.

Example: An Instrument has a scale reading of 0.01mm to 100mm. Here, the sensitivity of the instrument is 0.01mm i.e. the minimum value in the scale by which the instrument can read. The range is 0.01 to 100mm i.e. the minimum to maximum value by which the instrument can read.

4. Define system error and correction,

Error: The deviation between the results of measured value to the actual value.

Correction: The numerical value which should be added to the measured value to get the correct result.

5. Define measurand?

Measurand is the physical quantity or property like length, diameter, and angle to be measured.

6. Define deterministic Metrology.

The metrology in which part measurement is replaced by process measurement is called as deterministic metrology. The new techniques such as 3D error compensation by CNC systems are applied.

7. Define over damped and under damped system.

**Over damped** - The final indication of measurement is approached exponentially from one side.

**Under damped** - The pointer approaching the position corresponding to final reading and makes a number of oscillations around it.

8. Give any four methods of measurement

1. Direct method.
2. Indirect method.
3. Comparison method.
4. Coincidence method.

9. Give classification of measuring instruments.

1. Angle measuring Instruments.
2. Length measuring Instruments.
3. Instruments for surface finish.
4. Instruments for deviations.

10. Define True size:

True size is Theoretical size of a dimension

11. Define Actual size

Actual size = Size obtained through measurement with permissible error.

12. What is Hysteresis?

All the energy put into the stressed component when loaded is not recovered upon unloading. So, the output of measurement partially depends on input called hysteresis.

13. Differentiate accuracy and Uncertainty with example.

Accuracy - Closeness to the true value.

Example: Measuring accuracy is  $\pm 0.02\text{mm}$  for diameter 25mm. Here the measurement true values lie between 24.98 to 25.02 mm. Uncertainty about the true value =  $\pm 0.02\text{mm}$

14. Define Span:

The algebraic difference between higher calibration values to lower calibration value.

Example: In a measurement of temperature higher value is  $200^\circ\text{C}$  and lower value is  $150^\circ\text{C}$  means span =  $200 - 150 = 50^\circ\text{C}$

15 Differentiate between precision and accuracy.

Accuracy - The maximum amount by which the result differ from true value.

Precision - Degree of repetitiveness. If an instrument is not precise it will give different results for the same dimension for the repeated readings.

16. What is Scale interval?

It is the difference between two successive scale marks in units.

17. What is Response time?

The time at which the instrument begins its response for a change measured quantity.

18. Define Repeatability:

The ability of the measuring instrument to repeat the same results of the actual measurements for the same quantity is known as repeatability.

19. Explain the term magnification:

It means the magnitude of output signal of measuring instrument times increases to make it more readable.

20. Classify the Absolute error.

The absolute error is classified into

1. True absolute error
2. Apparent absolute error

21. What is Relative error?

Relative error is defined as the ratio of the absolute error and the value of comparison used for calculation of that absolute error. The comparison may be true value or conventional true value or arithmetic mean for series of measurement.

22. Classify the errors

The errors can be classified into

1. Static errors - Reading errors
  - Characteristic errors,
  - Environmental errors
2. Loading errors
3. Dynamic error

23. What is the basic Principle of measurement?

It is the physical phenomenon utilized in the measurement. If energy kind of quantity measured, there must be a unit to measure it. So this will give the quantity to be measured in number of that unit.

24. What are the applications of Legal metrology?

1. Industrial Measurement.
2. Commercial transactions
3. Public health and human safety ensuring.

24. What is the need of inspection?

To determine the fitness of new made materials, products or component part and to compare the materials, products to the established standard, inspections are needed.

25. What are the important elements of measurements?

The important elements of a measurement

1. Measurand
2. Reference
3. Comparator

26. What is LEGAL METROLOGY?

Legal metrology is part of Metrology and it is directed by a National Organisation which is called "Notional service of Legal Metrology". The main objective is to, maintain uniformity of measurement in a particular country.

### **16 MARKS**

- 1) Explain the various systematic and random errors in measurements?
- 2) What is the need of calibration? Explain the classification of various measuring methods.
- 3) Write detailed notes on :
  - (i) sensitivity
  - (ii) Calibration
  - (iii) Precision
  - (iv) Interchangeability
- 4) Define precision, accuracy, readability and sensitivity with respect to measurement.
- 5) Describe loading errors and environmental errors.
- 6) What are elements of a measuring system? How they affect accuracy and precision? How error due to these elements are eliminated