- Engineering Metrology and Measurements

TWO MARK QUESTION AND ANSWERS - UNIT 1

What is Range of measurement?

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

What are need for measurements.

☐ To ensure that the part to be measured conforms to the established standard.

☐ To meet the interchange ability of manufacture.

☐ To provide customer satisfaction by ensuring that no faulty product reaches the customers.

☐ To coordinate the functions of quality control, production, procurement & other departments of the organization.

Differentiate between sensitivity and range with suitable example.

An Instrument has a scale reading of 0.01mm to 100mm. Here, the sensitivity of the instrument is 0.0lmm 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.

What are basic elements of measuring system.

1.Primary sensing element 2. Variable conversion element 3. Variable manipulation element 4. Data transmission element 5. Data processing element 6. Data presentation element

What are the classification of standards.

Primary standard: It is only one material standard and is preserved under the most careful conditions and is used only for comparison with Secondary standard.

Secondary standard: It is similar to Primary standard as nearly as possible and is distributed to a number of places for safe custody and is used for occasional comparison with Tertiary standard

Tertiary standard: It is used for reference purposes in laboratories and workshops and is used for comparison with working standard.

Working standard: It is used daily in laboratories and workshops. Low grades of materials may be used.

What is accuracy.

Accuracy may be defined as the ability of instruments to respond to a true value of a measured variable under the reference conditions. It refers to how closely the measured value agrees with the true value.

What is precision.

Precision is defined as the degrees of exactness for which an instrument is designed or intended to perform. It refers to repeatability or consistency of measurement when the instruments are carried out under identical conditions at a short interval of time. It can also defined as the ability of the instruments to reproduce a group of the instruments as the same measured quantity under the same conditions.

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.

Define: Measurand.

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

Define over damped and under damped system.

Over damped - The final indication of measurement ii approached exponentially from one side. Under damped - The pointer approach the position corresponding to final reading and makes a number of oscillations around it.

Give any four methods of measurement.

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

Give classification of measuring instruments.

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

Differentiate accuracy and Uncertainty with example.

Accuracy - Closeness to the true value. Example: Measuring accuracy is ± 0.02mm for diameter 25mm. Here the measurement true values lie between 24.98 to25.02 mm Uncertanity about the true value = ± 0.02mm

Differentiate between precision and 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.

Define Repeatability:

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

Classify the Absolute error.

The absolute error is classified into

1. True absolute error and Apparent absolute error

What is Relative error?

Relative error is defined as the results 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 rnean for series of measurement.

Classify the errors.

The errors can be classified into 1. Static errors - Reading errors - Characteristic errors, - Environmental error 2. Loading error 3. Dynamic error

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.

What is Resolution?

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

Differentiate between sensitivity and range with suitable example.

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Define: Deterministic Metrology.

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

Define True size: True size is Theoretical size of a dimension

Define Actual size

Actual size = Size obtained through measurement with permissible error.

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.

Define Span:

The algebraic difference between higher calibration values to lower calibration value. Example: In a measurement of temperature higher value is 200*C and lower value is 1500C Mean span = 200 - 150 = 50'C

What is Scale interval?

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

What is Response time

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

Explain the term magnification:

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

What are the applications of Legal metrology ?

1. industrial Measurement.

2. Commercial transactions

3. Public health and human safety ensuring.

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.

What are the important elements of measurments?

The important elements of a measurement

1. Measurand

2. Reference and Comparator

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.

What is senstivity?

Sensitivity of the instrument is defined as the ratio of the magnitude of the output signal to the magnitude of the input signal.

☐ It denotes the smallest change in the measured variable to which the instruments responds.

☐ Sensitivity has no unique unit. It has wide range of the units which dependent up on the instrument or measuring system.

What is calibration.

Calibration is the process of determining and adjusting an instruments accuracy to make sure its accuracy is with in manufacturing specifications. It is the process of determining the values of the quantity being measured corresponding to a pre-established arbitrary scale. It is the measurement of measuring instrument. The quantity to be measured is the „input" to the measuring instrument.

What is interchangeability.

A part which can be substituted for the component manufactured to the small shape and dimensions is known a interchangeable part. The operation of substituting the part for similar manufactured components of the shape and dimensions is known as interchangeability.

List out the four controllable errors.

Calibration error

Environmental (Ambient /Atmospheric Condition) Error

Stylus pressure error

Avoidable error

Distinguish between repeatability and reproducibility.

Repeatability	Reproducibility
It is the variation in measurements taken by a single person or instrument on the same item and under the same conditions.	It is the ability of an entire experiment or study to be reproduced, by someone else working independently.
Such variability can be caused by, for example, intra-individual variability and intra-observer variability. A measurement may be said to be repeatable when this variation is smaller than some agreed limit.	It is one of the main principles of the scientific method. The result values are said to be commensurate if they are obtained according to the same reproducible experimental description and procedure

Distinguish between line standard and end standard.

It has already been clarified that the line standard of length is a highly inconvenient form for general measurement applications. In order to determine the position of the defining lines in standard employed. Since the line standard was defined first, and end standards being of real importance and more utility. the end standards had to be produced of the highest accuracy in relation to the line standard.

Define Cosine error.

Cosine error results from an angular misalignment between the motion of a positioning table, and the accuracy determining. Under most circumstances, it has a negligible effect on overall accuracy, owing to the significant degree of misalignment needed to influence accuracy.

What is mean by nominal science and tolerance?

Nominal size or trade size is a size "in name only" used for identification. The nominal size may not match any dimension of the product, but within the domain of that product the nominal size may correspond to a large number of highly standardized dimensions and tolerances.Tolerances are specified to allow reasonable leeway for imperfections and inherent variability without compromising performance.