



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

DEPARTMENT OF MECHANICAL ENGINEERING



$\text{ERROR} = \text{TRUE VALUE} - \text{MEASURED VALUE}$

TYPES OF ERRORS

1) Systematic error: It is the error which during several measurements, made under the same conditions, of the same value of a certain quantity, remains constant in absolute value and sign or varies in a predictable way in accordance with a specified law when the conditions change. The causes of these errors may be known or unknown. The errors may be constant or variable. Systematic errors are regularly repetitive in nature.

2) Random error: This error varies in an unpredictable manner in absolute value & in sign when a large number of measurements of the same value of a quantity are made under practically

identical conditions. Random errors are non-consistent. Random errors are normally of limited time duration.

3) Parasitic error: It is the error, often gross, which results from incorrect execution of measurement.

B) Instrumental error:

1) Error of a physical measure: It is the difference between the nominal value and the conventional true value reproduced by the physical measure. 2) Error of a measuring mechanism: It is the difference between the value indicated by the measuring mechanism and the conventional true value of the measured quantity. 3) Zero error: It is the indication of a measuring instrument for the zero value of the quantity measured. 4) Calibration error of a physical measure: It is the difference between the conventional true value reproduced by the physical measure and the nominal value of that measure. 5) Complementary error of a measuring instrument: It is the error of a measuring instrument arising from the fact that the values of the influence quantities are different from those corresponding to the reference conditions. 6) Error of indication of a measuring instrument: It is the difference between the measured values of a

quantity, when an influence quantity takes successively two specified values, without changing the quantity measured. 7) Error due to temperature: It is the error arising from the fact that the temperature of instrument does not maintain its reference value. 8) Error due to friction: It is the error due to the friction between the moving parts of the measuring instruments. 9) Error due to inertia: It is the error due to the inertia (mechanical, thermal or otherwise) of the parts of the measuring instrument.

Interpolation error: It is the reading error resulting from the inexact evaluation of the position of the index with regard to two adjacent graduation marks between which the index is located.

D) Based on nature of errors:

1) Systematic error: (already discussed) 2) Random error: (already discussed) 3) Illegitimate error: As the name implies, it should not exist. These include mistakes and blunders, computational errors and chaotic errors. Chaotic errors are random errors but unlike the latter, they create chaos in the final results.

E) Based on control:

1) **Controllable errors:** The sources of error are known and it is possible to have a control on these sources. These can be calibration errors, environmental errors and errors due to non-similarity of condition while calibrating and measuring.

Calibration errors: These are caused due to variation in the calibrated scale from its normal value. The actual length of standards such as slip gauges will vary from the nominal value by a small amount. This will cause an error of constant magnitude.

Environmental (Ambient /Atmospheric Condition) Errors: International agreement has been reached on ambient condition which is at 20°C temperature, 760 mm of Hg pressure and 10 mm of Hg humidity. Instruments are calibrated at these conditions. If there is any variation in the ambient condition, errors may creep into final results. Of the three, temperature effect is most considerable.

Stylus pressure errors: Though the pressure involved during measurement is generally small, this is sufficient enough to cause appreciable deformation of both the stylus and the work piece. This will cause an error in the measurement.

Avoidable errors: These errors may occur due to parallax in the reading of measuring instruments. This occurs when the scale and pointer are separated relative to one another. The two common practices to minimise this error are: i) Reduce the separation between the scale and pointer to minimum. ii) A mirror is placed behind the pointer to ensure normal reading of the scale in all the cases. These avoidable errors occur also due to non-alignment of work piece centers, improper location of measuring instruments, etc.

2) **Non-controllable errors:** These are random errors which are not controllable.

