Random and Systematic Error

Random and systematic errors are the type of errors that can occur in the measurement of the survey data. These errors can be generated due to human mistakes, improper adjustment of instruments, error in instruments, etc. removal of these errors are necessary before preceding the analysis of the survey data. The precision of the measurement is mainly affected due to the presence of random error.

Define Systematic and Random Error

Random and systematic errors are the type of errors that occur due to unpredictable changes in the instruments during the survey works. Systematic and random errors are important, as per the GATE CE syllabus. Random errors are those errors that occur due to any changes in the instrument during the surveying works. And systematic errors occur due to improper measurement and are predictable in nature.

Difference Between Random and Systematic Error

Random and systematic errors are the types of errors that can occur due to various factors during the measurement of the survey works. Below are a few basic differences between the random and systematic errors important for the GATE exam:

- Systematic errors are the same for similar data measurements, but random errors may differ for similar measurements.
- Random errors occur in the measurement due to any unpredictable changes during the measurement, while systematic errors are predictable in nature.
- The precision of the measurement is mainly affected by the presence of random errors in the data, while systematic errors affect the accuracy of the measurement.
- The elimination of random errors can not be done for a particular measurement, but systematic errors can be reduced.

Types of Random and Systematic Error

Types of Systematic Errors

The errors in the measurement can be classified as systematic, random, and blunders. Systematic errors are those errors that can be identified and fixed for a particular observation. Here are the 4 types of systematic errors are explained below. These types of errors are classified based on their causes during the measurement.

- Environmental: When the observations in the surroundings cause problems with the lab data of the measurement.

- Observational: Observational systematic error can occur if the observer does not report the correct data for the measurement.

- Instrumental: This will occur when any faults in the instruments are observed, like the instrument is not properly calibrated, etc.

- Theoretical: This will occur if any theoretical problems occur during the experiment. This will create inaccurate results in the measurement.

Types of Random Errors

Random errors are one of the types of errors in the measurement of surveying works. As per the theory of errors, it is those errors that can not be predicted before the observation. And also, the random errors for similar types of measurements can be different. It can be occurred due to environmental and observational changes during the observation. So, it can be classified into the environmental and observational types of random errors.

- Environmental: When the changes in the environmental conditions occur unpredictably, such condition readings taken by instruments will be different, and it will be the environmental type of random error.

- Observational: It will occur when the surveyor do mistakes during the observation. which is a random inaccuracy.

Random Error and Examples

Random error is a type of error that is random in nature. Random errors affect the precision of the observation in the measurements. Reasons to occur random errors in the measurement can be of different types, like changes in environmental factors, variations in the testing procedure, etc.

Examples of the Random Error

- Reading taken in different directions is a different value and comes into the category of random error.
- Measurement of the weight of a body through analytical balance technique.
- Measurement of a particular person's height may slightly differ while taking two or more observations due to the gesture changes.

As the random error is not predicted, multiple measurements need to be taken, and the most probable value is determined.

Systematic Error and Their Source

Systematic error is a type of error, similar to gross error, that is very systematic in nature. Systematic errors affect the accuracy of the observation. Reasons to occur systematic errors in the measurement can be of different types, like observational factors, calibration in instruments, etc.

Examples of the Systematic Error

- During the measurement of the weight of a body forgot to set out the zero. It will cause the measurements to differ by the same amount.
- Measuring the length of a chain in cold and hot weather.
- Measuring the distance between the two different types manufactured with different materials.