



SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution)
COIMBATORE-35
DEPARTMENT OF BIOMEDICAL ENGINEERING



23BMT203 BIOMEDICAL TRANSDUCERS AND SENSORS

II BME - IV SEM

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Unit-1 Fundamental of Measurement

1. Determination of an Absolute Quantity in Measurement

The determination of an absolute quantity refers to measuring a physical parameter in terms of fundamental units without requiring reference to other measurements. These measurements are based on fundamental constants or primary standards, such as determining mass using a balance calibrated with standard weights.

2. Significance of Standards in Measurement Systems

Standards ensure uniformity, accuracy, and reliability in measurements. They provide reference values for calibration, reduce measurement discrepancies, and enable consistency in scientific research, engineering applications, and industrial processes.

3. Definition of Calibration and Its Necessity

Calibration is the process of comparing a measurement instrument's output with a known reference standard to determine its accuracy and correct any deviations.

Necessity:

- Ensures measurement accuracy and reliability
- Detects and corrects instrument drift over time
- Maintains compliance with industry standards
- Enhances repeatability and traceability of measurements

4. Importance of Absolute Measurements in Scientific Experiments and Calibration

- Provide fundamental reference values for accurate comparisons
- Ensure reproducibility of results across different conditions and locations
- Essential for defining and verifying international measurement standards
- Crucial for high-precision experiments in physics, chemistry, and engineering

5. Difference Between Accuracy and Precision

Accuracy: The closeness of a measured value to the true value of a quantity.

Precision: The consistency of repeated measurements, regardless of whether they are close to the true value.

6. Systematic Errors vs. Random Errors

Systematic Errors: Consistent deviations from the true value due to instrumental, environmental, or procedural factors (e.g., miscalibrated instruments). These errors can be corrected.

Random Errors: Unpredictable variations in measurements caused by uncontrollable factors like sensor noise or fluctuations in conditions. These errors can be minimized but not eliminated.

7. **What is noise in a measurement system?**

Noise is any unwanted signal that interferes with the measurement of the desired signal, reducing accuracy.

8. **What is Signal-to-Noise Ratio (SNR)?**

SNR is the ratio of the power of the desired signal to the power of background noise, indicating measurement quality.

9. **What is aliasing in signal measurement?**

Aliasing occurs when a signal is sampled below the Nyquist rate, leading to distorted or misleading results.

10. **What is the difference between accuracy and precision?**

Accuracy refers to how close a measurement is to the true value, while precision indicates repeatability.

11. **Define sensitivity and resolution in a measurement system.**

Sensitivity is the ratio of output change to input change in a measurement system.

Resolution is the smallest detectable change in a measurement system's output.

12. **What is hysteresis in a measurement system?**

Hysteresis occurs when a system's output differs for the same input based on prior measurements.

13. **Define response time in a dynamic measurement system.**

Response time is the time taken for a system to reach a steady output after an input change.

14. **What is the purpose of calibration?**

Calibration ensures measurement accuracy by comparing an instrument's output with a known standard.

15. What is a primary standard in measurement?

A primary standard is a highly accurate reference used for calibration, traceable to national/international standards.

16. Differentiate between systematic and random errors.

Systematic errors are predictable and consistent, while random errors occur unpredictably due to unknown factors.

17. How can measurement accuracy be improved?

By regular calibration, minimizing external disturbances, and using high-quality instruments.

18. Why are SI units preferred in measurements?

SI units provide a universal, standardized system for accurate and consistent measurements worldwide.

19. What are the seven SI base quantities?

Length, mass, time, electric current, temperature, amount of substance, and luminous intensity.

20. What is the main challenge in measuring blood pressure accurately?

Ensuring proper cuff placement and avoiding external disturbances.