	Akhil Bharatiya Maratha Shikshan Parishad's Anantrao Pawar College of Engineering & Research	
	Bachelor of Vocational	
Notes		

Subject Notes

Class: FY BVOC **Semester: I**
Subject: Electronic Measurements and Instrumentation-I **Academic Year: 2024-25**

Unit 1: Unit, dimensions and standards
Unit 2: Measurement Errors

MCQs (1 Mark Each Questions)

Q.1 What is the SI unit for electric resistance?

- A) Ampere
- B) Volt
- C) Ohm
- D) Watt

Answer: C) Ohm

Q. 2 Which of the following units measures electrical power in the SI system?

- A) Ohm
- B) Joule
- C) Watt
- D) Farad

Answer: C) Watt

Q. 3 Which unit is commonly used to measure length in the US customary system?

- A) Meter
- B) Yard
- C) Kilogram
- D) Liter

Answer: B) Yard

Q.4 Which metric prefix represents 10^6**?**

- A) Mega
- B) Giga
- C) Kilo
- D) Tera

Answer: A) Mega

Q.5 In the context of dimensional analysis, what is the dimension of velocity?

- A) [M][L]^2[T]^-2
- B) [M][L][T]^-1
- C) [M][L][T]^-2
- D) [L][T]^-1

Answer: B) [M][L][T]ˆ−1

Q.6 What is the metric prefix for 10^{-9}?

- A) Nano
- B) Micro
- C) Milli
- D) Pico

Answer: A) Nano

Q.7 Which temperature scale is used in the SI system and has its zero point at absolute zero?

- A) Celsius
- B) Fahrenheit
- C) Kelvin
- D) Rankine

Answer: C) Kelvin

Q.8 Which unit is commonly used to measure length in the US customary system?

- A) Meter
- B) Yard
- C) Kilogram
- D) Liter

Answer: B) Yard

Q.9 What is the absolute error of a measurement?

- A) The difference between the measured value and the true value
- B) The ratio of the absolute error to the true value
- C) The maximum possible error in the measurement process
- D) The standard deviation of multiple measurements

Answer:A) The difference between the measured value and the true value

Q.10 Which of the following statements about the mode is true?

- A) It is the average of the dataset.
- B) It is the value that appears most frequently in the dataset.
- C) It is the middle value when the dataset is ordered.
- D) It is the difference between the highest and lowest values in the dataset

Answer: B) It is the value that appears most frequently in the dataset.

Q.11 What is the median of the dataset {3, 7, 5, 9, 2}?

- A) 5
- B) 7
- C) 6
- D) 9

Answer: A) 5

Q.12 If two measurements have absolute errors of ±0.2\pm 0.2±0.2 **and** ±0.3\pm 0.3±0.3 **respectively, what is the combined absolute error?**

- A) ±0.5
- B) ±0.7
- C) ±0.1
- D) ±0.6

Answer: A) ±0.5

Q.13 How many significant figures are in the number 0.00450?

- A) 2
- B) 3
- C) 4
- D) 5

Answer: B) 3

Q.14 What does "resolution" refer to in a measurement instrument?

- A) The smallest increment that the instrument can measure
- B) The accuracy of the instrument
- C) The degree to which an instrument can detect small changes in a quantity
- D) The consistency of measurements made with the instrument

Answer: A) The smallest increment that the instrument can measure

Q.15 How is relative error defined?

- A) The absolute error divided by the measured value
- B) The absolute error divided by the true value
- C) The difference between the highest and lowest measurements
- D) The square root of the absolute error

Answer: B) The absolute error divided by the true value

Q.16 What is a gross error?

- A) An error due to incorrect measurement techniques
- B) An error resulting from faults in the measuring instrument
- C) An error due to human mistakes or equipment malfunction
- D) An error inherent in the measurement system

Answer: C) An error due to human mistakes or equipment malfunction

2 Marks Questions

Q.1. What are scientific Notations?

Solution 1: scientific notation is a way of expressing very large or very small numbers in a compact and manageable format. Format of Scientific Notation

A number in scientific notation is written in the form: $N=M\times10^{E}$ where:

- M is the **mantissa** (or coefficient), a number greater than or equal to 1 and less than 10.
- E is the **exponent**, an integer that indicates the power of 10 by which MMM is multiplied.

Examples: Large Numbers: 4,500,000

- **Scientific Notation**: 4.5×10^{6}
- **Explanation**: Move the decimal point 6 places to the right to get back to the original number.

Q.2 Identify the base SI unit for time and explain its significance.

Solution 2: The base SI unit for time is the second (s). It is a fundamental unit used to measure the duration of events and intervals.

Q.3 Explain the concept of dimensional analysis and its importance in physics.

Solution 3: Dimensional analysis involves checking the dimensions of physical quantities to ensure that equations and formulas are dimension ally consistent. It helps in verifying the correctness of equations and converting units in physical calculations.

Q.4 what are Other unit systems?

Solution 4:0ther unit systems refer to measurement systems that are used alongside or instead of the International System of Units (SI).
CGS System (Centimeter-Gram-Second System):A metric system that uses centimeters, grams, and seconds as base units.
MKS System (Meter-Kilogram-Second System):A precursor to the SI system, where meter, kilogram, and second are base units.

Q.5 Explain the relationship between voltage (V), current (I), and resistance (R) in Ohm's Law.

Solution 5**:** Ohm's Law states that V=I×RV = I \times RV=I×R. This means that the voltage across a conductor is equal to the current flowing through it multiplied by its resistance.

Q.6 Define gross error and provide an example.

Solution 6: Gross errors are large mistakes or mistakes due to miscalculation or misuse of equipment. For example, if a balance is miscalibrated and shows an incorrect reading of 150 grams instead of 100 grams, this could be a gross error.

Q.7 Differentiate between accuracy and precision.

Solution 7: Accuracy refers to how close a measured value is to the true value, while precision refers to the consistency of repeated measurements, regardless of how close they are to the true value.

Q.8 Explain what resolution means in the context of a measuring instrument.

Solution 8: Resolution is the smallest change in a measured quantity that an instrument can detect. It defines the level of detail or the smallest increment that the instrument can display.

Q.9 **How many significant figures are in the number 0.004560?**

Solution 9: There are 4 significant figures (4, 5, 6, and the trailing zero after the decimal point).

Q.10 I**f two measurements have uncertainties of ±0.2 and ±0.3, what is the combined uncertainty in the sum of these measurements?**

Solution 10: The combined uncertainty is ±(0.2 + 0.3) = ±0.5.

4 Marks Questions

Q.1. What is SI Unit? Give examples of SI Units?

Solution 1: The SI unit refers to the International System of Units, which is the standard system of measurement used globally in science, industry, and everyday life. It provides a consistent framework for measurement by defining seven base units from which other units are derived.

Base Quantity		Base Unit	
Name	Symbol	Name	Symbol
Length	l, h, r	meter	m
Mass	m	kilogram	kg
Time	t	second	s
Electric current	I, i	ampere	A
Temperature	T	kelvin	K
Amount of substance	n	mole	mol
Luminous intensity	I_v	candela	cd

Q.2. For a set of data points: {8, 6, 9, 5, 7}, calculate the range, variance, and standard deviation.

Solution 2: Range: Range = Maximum value - Minimum value = 9 - 5 = 4.

Variance:

- Mean = (8 + 6 + 9 + 5 + 7) / 5 = 35 / 5 = 7.
- Variance = [$(8-7)^2 + (6-7)^2 + (9-7)^2 + (5-7)^2 + (7-7)^2$] / (5-1) = [1 + 1 + 4 + 4 + 0] / 4 = 10 / 4 = 2.5.

Standard Deviation: SD = √Variance = $\sqrt{2.5} \approx 1.58$.

Q.3. perform the following calculations and express the results with the correct number of significant figures: (a) 4.56 × 0.0047 and (b) (12.56 + 1.2) / 3.
Solution:

(a) 4.56 × 0.0047:

- **Calculation**: 4.56 × 0.0047 = 0.021432
- **Significant Figures**: The result should be expressed with the least number of significant figures from the numbers used (2 significant figures for 0.0047). Thus, the answer is 0.021.

(b) (12.56 + 1.2) / 3:

- **Calculation**: (12.56 + 1.2) = 13.76; 13.76 / 3 = 4.586666...
- **Significant Figures**: The result should be expressed with the least number of decimal places from the numbers used (1 decimal place from 1.2). Thus, the answer is 4.6.

Q.4 Discuss how gross errors can be identified and corrected in an experiment. Provide an example of a gross error and its impact on the results.

Solution: Gross errors are often identified through anomalous results that deviate significantly from the expected values or through recalibration of instruments. They can be corrected by recalibrating equipment, repeating measurements, or checking the methodology.

Example: If a scale used to weigh substances is miscalibrated and consistently shows 10 grams more than the actual weight, this gross error will lead to inaccurate results across all measurements. The impact would be consistently erroneous data, which could mislead conclusions drawn from the experiment.

Q.5. Convert the following numbers into scientific notation and standard decimal form: (a) 0.0000567 and (b) 7.89 × 10^5. Explain the process of conversion for each.

Solution:**(a) 0.0000567**:

Scientific Notation: 5.67×10^{-5}

Process: Move the decimal point 5 places to the right to convert 0.0000567 to 5.67, and note that this is equivalent to multiplying by 10−5

(b) 7.89 × 10^5:

Standard Decimal Form: 789,000

Process: Move the decimal point 5 places to the right from 7.89 to get 789,000.

Q.6 Discuss the significance of the Kelvin scale in scientific measurements and explain why it does not have a degree symbol (°).

Solution: Significance: The Kelvin scale is used in scientific measurements because it starts at absolute zero, the theoretically lowest possible temperature where molecular motion ceases. This scale is crucial for thermodynamic calculations.

No Degree Symbol: The Kelvin scale does not use the degree symbol because it is an absolute temperature scale, unlike Celsius and Fahrenheit, which are relative and based on specific reference points.