EXPERIMENT 1: MEASUREMENT AND UNCERTAINTY

Course Learning Outcome:
Solve problems related to Physics of motion, force and energy, waves, matter and thermodynamics
(C4, PLO 4, CTPS 3, MQF LOD 6)

Learning Outcomes:
At the end of this lesson, students will able to describe technique of measurement and determine uncertainty of length of various objects.

Student Learning Time:

Face-to-face	Non face-to-face
1 hour	1 hour

Direction: Read over the lab manual and then answer the following question.

Introduction

1. Complete **Table 1**

Basic Quantity	Symbol	SI Unit (with symbol)	Measuring Instrument
Length	*l*		
Mass	*m*		
Time	*t*		
Electric Current	*I*		
Temperature	*T*		

Table 1

2. …………………………….. is used to measure the diameter of a coin.

3. Micrometer screw gauge is usually used to measure the …………………… of a thin wire or the …………………………………. of paper.

4. Complete **Table 2**

Measuring Instrument	Uncertainty
Ruler	$\pm$

Vernier callipers	±
Micrometer screw gauge	±

Table 2

5. State **TWO** types of reading;

   i.   ……………………………………………………………

   ii.   ……………………………………………………………

6. The repeated reading for a measurement is given as *a, b, c, d,* and e. Write the equation of Average Value and Uncertainty.

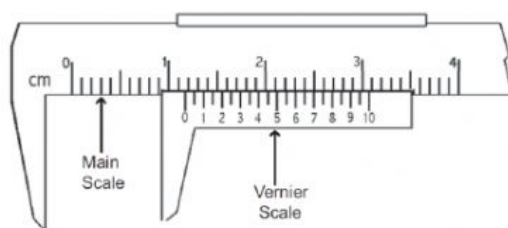|	EQUATION
Average Value, $\bar{x}$	
Uncertainty, $\Delta \bar{x}$	

Experiment

7. Complete **Table 3**

Measurement	Measuring Instrument	Uncertainty/ Smallest scale	Type of reading (single point/two point/Vernier scale)
Length of a book		±	
Diameter of a spherical object		±	
Width of a square object		±	

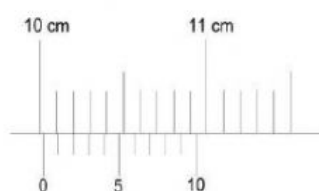**Table 3**
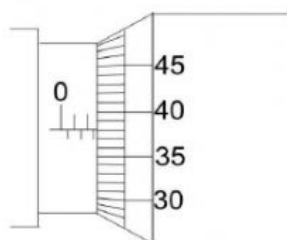
8. Determine the reading for the following measurements:

Main scale   : ....
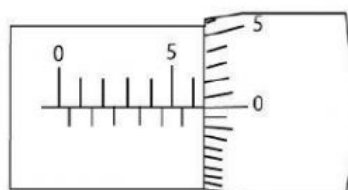Vernier scale : ....
Actual reading : ....

Uncertainty: ± 0.05 mm

Main scale   :.............
Vernier scale :.............
Actual reading : ....

Uncertainty   : ± 0.01 mm

Main scale   : ....
Vernier scale : ....
        Actual reading : ....

Uncertainty   : ± 0.01 mm

Main scale   : ....
Vernier scale :_.............
Actual reading :.............

Uncertainty   : ± 0.01 mm

Data Analysis

9. Complete **Table 4**

No	Diameter of ball bearing, d (± 0.01 mm)	$\lvert \underline{d} - d_i \rvert$ (mm)
1	2.50	
2	2.52	
3	2.51	
4	2.50	
	Average =	$\Delta\underline{d} =$

Table 4

10. Express your answer as $(\underline{d} \pm \Delta\underline{d})$

　　　　　(　　　 ± 　　　) mm

11. Calculate the percentage of uncertainty.

$$\frac{\Delta\bar{d}}{d} \times 100\% =$$

12. List **THREE** precautions of the experiment:

i. …………………………………………………………………………………………………...

ii. …………………………………………………………………………………………………..

iii. …………………………………………………………………………………………………..