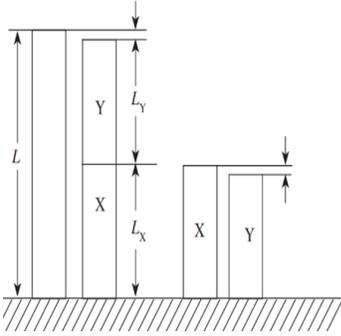


Name:			
Enrolment No:			
UPES End Semester Examination, December 2023			
Course: Introduction to Metrology Program: M.Sc. Physics Course Code: PHYS 8019		Semester: III Time : 03 hrs. Max. Marks: 100	
Instructions:			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Define unilateral and bilateral tolerances. Give examples for each.	4	CO1
Q 2	Describe the nanometrology. What is the scope of nanometrology?	4	CO1
Q 3	Explain various types of systematic and random measurement errors with suitable examples.	4	CO2
Q 4	Explain the contribution of NPL to metrology. List the objectives of NPL.	4	CO2
Q 5	Briefly explain legal and deterministic metrology.	4	CO1
SECTION B (4Qx10M= 40 Marks)			
Q 6	Define “systematic errors” and explain the causes of those errors with suitable example.	10	CO4
Q 7	Briefly discuss the important points required for gauge design. Write a short note on gauge material.	10	CO3
Q 8	With the help of suitable example explain the term precision and accuracy.	10	CO2
Q 9	Write a note on materials standards. Briefly explain the major disadvantages of material standard. OR Explain the role of standards of measurements. Distinguish between primary, secondary, tertiary, and working standards.	10	CO1
SECTION-C (2Qx20M=40 Marks)			
Q 10	(a) Differentiate hole basis and shaft basis systems. (b) Tolerances for a hole and shaft assembly having a nominal size of 50 mm are as follows: $\begin{matrix} +0.02 & -0.05 \\ \text{Hole} = 50^{+0.00} \text{ mm and shaft} = 50^{-0.08} \text{ mm} \end{matrix}$ Determine the followings: (a) Maximum and minimum clearances (b)	10+10	CO3

	<p>Tolerances on shaft and hole.</p> <p style="text-align: center;">OR</p> <p>(a) Define accuracy and precision. Discuss the relationship between accuracy and cost.</p> <p>(b) A calibrated end bar having an actual length of 500.0005 mm is to be used to calibrate two end bars X and Y, each having a basic length of 250 mm. On comparison, the combined length $L_X + L_Y$ is found to be shorter than the 500 mm end bar by 0.0003 mm. When the two end bars X and Y are compared with each other, X is found to be 0.0006 mm longer than Y. Determine L_X and L_Y.</p> 		
Q 11	<p>(a) Write the uses and applications of Sine bar in industries. What is the basic difference between sine bars, sine plates, and sine tables?</p> <p>(b) Discuss the guidelines to be followed for the proper use of a vernier calliper. In a vernier calliper, the main scale reads in millimetres with a least count of 0.1mm. Ten divisions on the vernier correspond to nine divisions of the main scale. Determine the least count of the calliper.</p>	10+10	CO2