Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2019

Course: Mechanical Measurement & Metrology **Semester: IV**

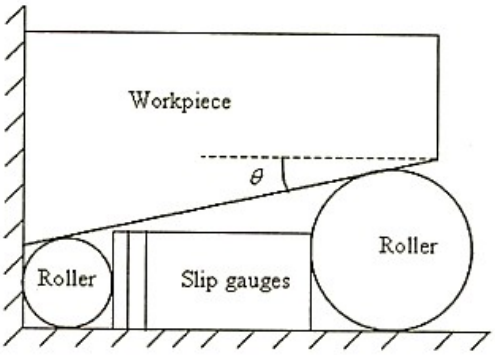
Program: B.Tech Mechanical **Time 03 hrs.**

Course Code: MEPD2003 **Max. Marks: 100**

Instructions:

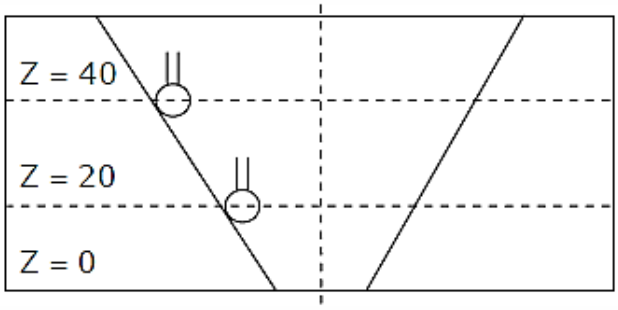
1. *Assume the data if required.*
2. *Be brief and specific.*

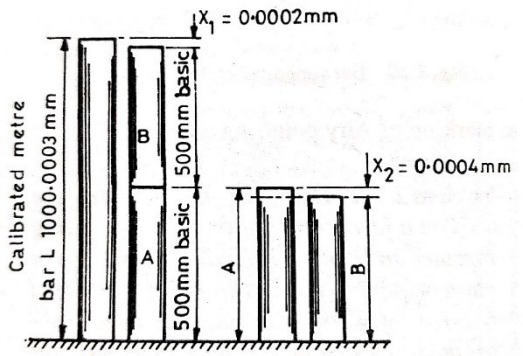
SECTION A

S. No.	Statement of Question	Marks	CO
1	Explain the working principle of bimetallic thermometers. Why bimetallic thermometers are preferred over liquid-in-glass thermometers?	**5**	**CO1**
2	An experimental setup is planned to determine the taper of work piece as shown in the figure. If the two precision rollers have radii 8 mm and 5 mm and the total thickness of slip gauges inserted between the rollers is 15.54 mm. Find out the taper angle θ 	**5**	**CO2**
3.	What is mean by a gear tooth thickness? Describe briefly how you measure it with the help of a Gear Tooth Vernier.	**5**	**CO3**
4.	Discuss how the accuracy of measurement is affected by the following 1. Poor contact between the workpiece and measuring probe 2. Distortion of the workpiece under gauge pressure	**5**	**CO4**

SECTION B

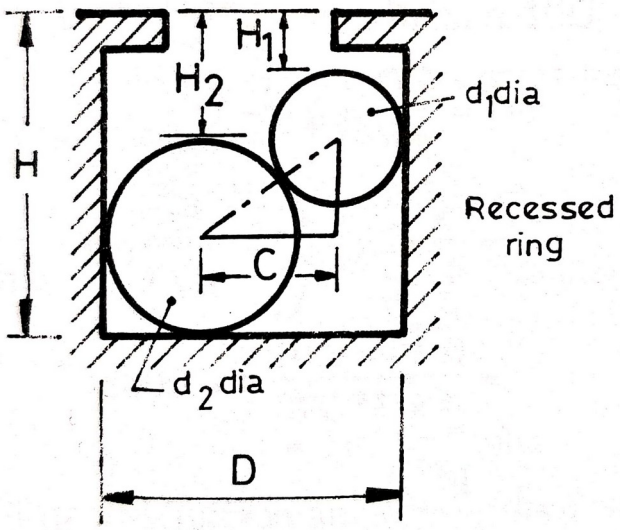
5.	Discuss in detail working principle, components and structure of CMM. A taper hole is inspected using a CMM, with a probe of 2 mm diameter as shown in figure. At a height, Z=10mm from the bottom, 5 points are touched and a diameter of circle (not	**7+3**	**CO1**

	compensated for probe size) is obtained as 20mm. similarly, a 40mm diameter is obtained at a height Z=40mm. What is the diameter (in mm) of taper hole at Z=0?  		
6.	1. The surface finish on the flat faced surface of a turned workpiece is not to exceed 5 microns R_{av}, the measurement to be made at a meter cut off 0.8mm and to be made at right angle to the machining marks (radially). Explain the meaning of this specification and how it will be shown on the drawing. 2. In the measurement of surface roughness, heights of 20 successive peaks and troughs were measured from a datum and were: 35, 25, 40, 22, 35, 18, 42, 25, 35, 22, 36, 18, 42, 22, 32, 21, 37, 18, 35, 20 microns. If these measurements are obtained over a length of 20mm, determine the CLA and RMS values of the rough surface.	**3+7**	**CO2**
7.	1. List the important characteristics of bonded and un-bonded type of strain gauges 2. A resistance wire strain gauge with a gauge factor of 2 is bonded to a steel structure member subjected to a stress of 100 MPa. The modulus of elasticity of the steel is 200 GPa. Calculate the percentage change in the gauge resistance due to the applied stress. 3. Suggest a complete instrumentation scheme in block diagram form to measure the pressure in a closed chamber with the help of bonded strain gauges as basis sensing element	**3+3+4**	**CO3**
8.	A calibrated metre end bar has an actual length of 1000.0003mm as shown in figure. It is found to be used in the calibration of two bars, A and B each having a basic length of 500mm. When compared with the metre bar $L_A + L_B$ was found to be shorter by 0.0002mm. In comparing A and B it was found that A was 0.0004mm longer than B. Find the actual length of A and B.	**10**	**CO4**



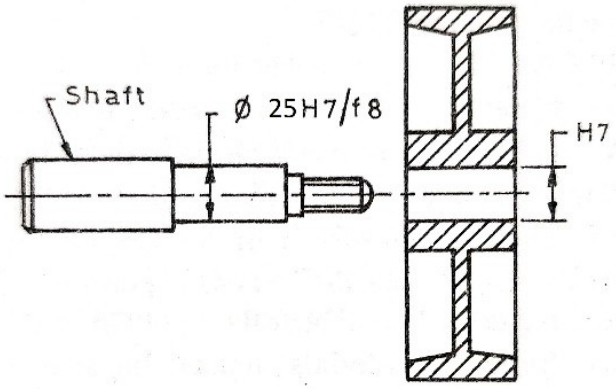
OR

The diameter of a recessed ring was measured with the help of two balls as shown in figure. One ball of 60mm (d_2) diameter touching one side of the length of the ring and a 40mm (d_1) ball resting over it and touching the other side of the ring. The distance from the top surface to the top of 60mm ball was 35.55mm (H_2) and the corresponding distance from the 40mm ball was 20.55mm (H_1). Determine the diameter (D) and length of the ring gauge (H).



SECTION-C

9.	Design the workshop, inspection and general type of GO and Not-GO gauge for checking the assembly as shown in figure of hole and shaft system 25H7f8. Being given	**15+5**	**CO4**

	 • i (microns) = 0.45 $D^{1/3}$ + 0.001D microns • Fundamental shaft deviation for f shaft = -5.5 $D^{0.41}$ microns • 25 mm falls in the diameter step of 18 and 30. • If gauges are being made of some non-standard material for, which it is essential to take the wear allowance as 8% of the gauge tolerance • The values of tolerances for IT7 & IT8 grades are 16i & 25i respectively. Also determine a) Type of fit b) Allowance of the above fit c) other shafts giving the same type and same degree of fit d) Is there any possibility of accepting some non-conforming product? e) Suggest a suitable material for both the gauges, including some reference to the heat treatment.		
10.	1. What is the objective of measurement of thread elements? Mention some important thread elements of linear measurements. 2. What is meant by the best wire size and explain the procedure to measure the effective diameter of a screw thread with the help of neat sketch. 3. In a three-wire inspection of external thread of M16×2, the measurement over the wires was found to be 16.455 mm. Find out the best wire size and effective diameter of the thread. **OR** 1. Explain the reasons for (i) Generally three wires are used to measure a screw with a hand micrometer and only two wires when using a floating carriage machine for the same purpose? (ii) A screw is never placed on centres to measure its major diameter whereas for measuring the effective or minor diameter it is placed on the centres. 2. A screw thread M10×1 is measured for major effective diameter on a screw-measuring machine. The micrometer is standardized on a slip gauge and, due	**6+7+7**	**CO3**

	to misalignment in its plastic handle, the plug gauge can lie at an angle of 5 minutes to the line of centres of the machine, which is self-satisfactory parallel to the micrometer faces. What errors are likely to be introduced into both major and effective diameter measurements due to this condition? The micrometer anvil is 5mm in diameter. 3. When measuring the effective diameter of an external screw thread gauge of 3.5mm pitch, a 30.500mm diameter cylindrical standard and 2.000mm wires were used. The micrometer readings over the standard and wires, and gauges and cylinders were 13.3768mm and 12.2428mm respectively. Calculate the thread gauge effective diameter.		