

Name:.....

Roll No.:.....

NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

Department of Mechanical Engineering

End Semester Examination, May 2009

IV Semester B.Tech. – Production Engineering

MEV614 METROLOGY AND COMPUTER AIDED INSPECTION

Time: Three hours

Maximum Marks: 50

All questions carry 2 marks each, unless otherwise mentioned. Metrology Tables will be provided.

1. Define the terms "Measurement Accuracy" and "Measurement Trueness" and differentiate between them.
2. Sketch the block diagram of a general measurement system.
3. Explain the term "drift" as applied to measuring instruments.
4. Explain the term "interference" in connection with conduct of experiments and how it can be minimized.
5. The diameter of a cylinder was measured 5 times with readings 50.1, 50.2, 50.4, 50.4 and 50.2 mm. Its height was measured as 200.2 mm with uncertainty uniformly distributed between +/-0.4 mm. The height and diameter measurements have a correlation coefficient 0.5. Determine the 95% expanded uncertainty interval for volume of the cylinder. Neglect the effect of correlation on the degrees of freedom and tabulate the intermediate results neatly in the uncertainty budget format given below.

Quantity	Value	Std Unc	dof	Contribution
Diameter	? mm			
Height	200.2 mm			
Correlation	-	-	-	
Volume	? mm ³			

(8 marks)

6. Compare thermocouples and thermistors in their application for temperature measurement.
7. A thermometer of time constant 2s and kept at a room temperature of 25 °C was suddenly dipped into hot water at 50 °C. Determine the temperature shown by the thermometer after 6s.
8. A vibration of frequency 20 Hz was applied to a displacement sensor with a natural frequency of 10rad/s and damping ratio 0.2. Sketch qualitatively the displacement shown by the sensor during the period from 0 to 10radians.
9. Design a GO and NOGO plug gauge (determine dimensions and sketch) to check a hole of dia 30+0.08mm. Allow a unilateral gauge tolerance of 10% with a wear allowance equal to half the gauge tolerance. (4 marks)
10. A micrometer with spindle dia of 5mm was used to measure the diameter of a cylinder and a reading of 15.32 was obtained. Estimate the correct diameter of the cylinder if the micrometer was misaligned by 2°.
11. Compare the common materials used for making gauge blocks.
12. An angle gauge block set has sizes: 1, 3, 9, 27 & 41 degrees; 1, 3, 9 & 27 minutes; and 3, 6, 18 & 30 seconds. Select a set of blocks to achieve a combined angle of 40°2'9".
13. What do you mean by reproducibility? In an R&R study using two repeated measurement of ten objects, the averages of three observers were obtained as 5.67, 5.62, and 5.71 mm respectively. Estimate the reproducibility.

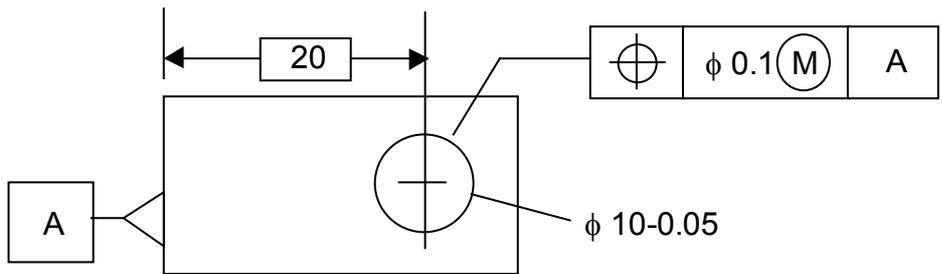
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14. Sketch the pattern of fringes when an optical flat is placed over a slightly convex object and illuminated with monochromatic light. How can you verify whether the object is concave or convex?
15. Sketch and label the different parts of the probing system of a CMM.
16. What is the difference between workpiece coordinate systems and machine coordinate systems in CMMs? What purpose do they serve?

17. Sketch the two bit image represented by the matrix

0	1	2	3	
1	0	1	2	and identify the brightest regions.
2	1	0	1	
3	2	1	0	

18. Explain the principle of any one method of edge detection in Machine Vision.
19. What do you mean by 'Simulated Datum Feature' ? Explain.
20. Sketch and distinguish the four different reference circles that can be used to determine circularity.
21. A workpiece machined as per drawing below, was inspected. The hole diameter was measured as 9.98 mm



and its centre distance from datum A as 20.12 mm. Is the part acceptable? Why or why not?

22. Differentiate between roughness, waviness and form error.
23. The heights of a surface profile from an arbitrary datum were obtained as: 1.16, -0.47, -1.23, -1.23, -0.4, -1.36, -1.29, 0.59, -0.41, -1.42, 0.41, -0.71, 1.26, -1.16, -1.26, 1.33, -1.28, 0.62, -0.67, 0.98 (μm) in steps of 0.1mm along the x axis. Determine R_q for the profile. Assume that the surface is well aligned with the datum. (4 marks)
24. Give one good point about this course b) Give one suggestion which you think will best improve this course.