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Roll No.:.....

NATIONAL INSTITUTE OF TECHNOLOGY CALICUT
 Department of Mechanical Engineering
End Semester Examination, Nov-Dec 2012
I Semester M.Tech. – Manufacturing Technology

ME6303 ADVANCED METROLOGY AND COMPUTER AIDED INSPECTION

Time: Three hours

Maximum Marks: 50

All questions carry 2 marks each, unless mentioned otherwise.

1. Define the terms Systematic error and Random error and differentiate between them.

2. The time period of a simple pendulum is given by $T = 2\pi\sqrt{\frac{l}{g}}$, where l is the length of the pendulum

and g the acceleration due to gravity. The length of a pendulum has been measured as 1.2 m with a triangularly distributed uncertainty +/-0.003 m. The value of g is obtained from a handbook as 9.8 m/s², with a 99% confidence interval of +/- 0.02 m/s² having 9 degrees of freedom. Estimate the time period of the pendulum and its 95% expanded uncertainty interval.

(4 marks)

3. Two devices are connected in parallel. The current across each device was measured using two ammeters at several times as in table below. Determine the correlation between the current in the two devices and hence the standard uncertainty in the total current drawn.

Trial	1	2	3	4	5
Device A	5.1	4.9	5.1	5.3	4.8
Device B	10.2	9.8	9.7	10.4	9.7

(4 marks)

4. Five repeated readings of a shaft using a micrometer with least count 0.01 mm were 5.85, 5.93, 6.03, 5.87, and 5.98 mm. The same shaft was measured at the same locations with a vernier of least count 0.1 mm and the readings were 5.9, 5.9, 6, 5.9, and 6 mm respectively. Compare the uncertainties of both instruments and discuss the result.

5. What is the main advantage of a Fixed Bridge CMM? Why?

6. Explain the effect of form error on sampling strategy.

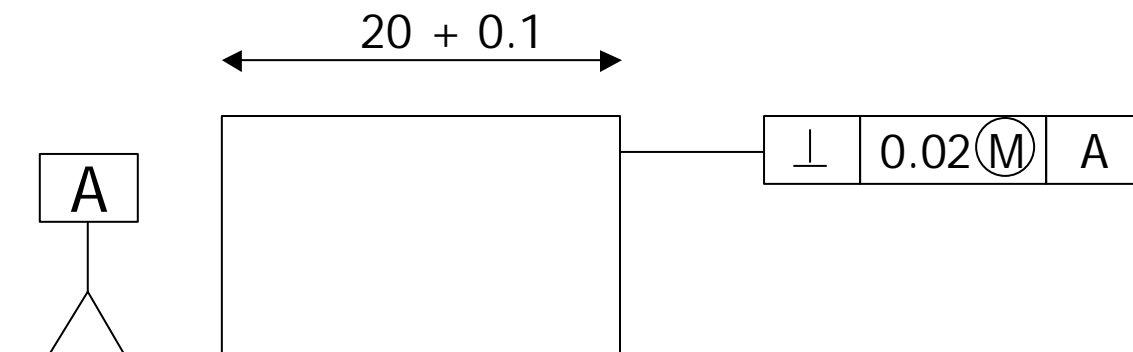
7. Distinguish between datum, datum feature and simulated datum feature.

8. Determine the straightness error with respect to the end point line for the straightness measurement data:

x (mm)	50	150	200	250	300	350	400
y (µm)	4	1	2	7	6	2	3

(3 marks)

9. A component was inspected as per this drawing



and the dimension was 20.08 mm with the perpendicularity error value of 0.03 mm. Is the component acceptable? Give reasons.

10. Sketch the symbol for the geometrical tolerance "Profile of a line" and explain how it is inspected.
11. Explain the difference between raw profile and primary profile in surface finish measurement.
12. Determine R_q for the following data from a surface profilometer. Neglect slope of the mean line.

x (mm)	0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8
y' (μm)	6	0	3	4	2	3	2	4	4	5	2	4	6	2	1

(3 marks)

13. Explain the method recommended for determining the cut-off for non-periodic surfaces.
14. Sketch the autocorrelation function for a turned and ground surface and explain the reason for the pattern observed.
15. A camera takes images of 2272 X 1704 pixels. Determine the resolution of the camera in Megapixels.
16. Explain the differences between CCD and CMOS sensors.
17. Explain the strategy of redundancy reduction for file compression.
18. Determine D_e , D_4 and D_8 between pixels (5,4) and (3,7).
19. Discuss the two methods of dealing with the border when using spatial filters.
20. Determine the histogram, choose a suitable threshold, segment and identify the letter in the three bit

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0 1 2 1
2 5 6 2
image3 6 1 3.
1 5 7 1
2 3 1 2

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(4 marks)

21. Sketch the object represented by the 4-directional shape number 0011311311.
22. a) Give one good point about this course b) Give one suggestion which you think will best improve this course.

15.

2272 0 1704 0 3871488

18.

p	5	4
q	3	7
De	3.605551	
D4	5	
D8	3	

20.

0	1	2	1
2	5	6	2
3	6	1	3
1	5	7	1
2	3	1	2

0	1
1	6
2	45
3	3
4	
5	2
6	2
7	1

C

21.

