NATIONAL INSTITUTE OF TECHNOLOGY CALICUT
Department of Mechanical Engineering
End Semester Examination, Nov-Dec 2010
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. A standard pressure of 2.5 bar was applied to a pressure gauge five times, and the readings were 2.7, 2.8, 2.7, 2.6, and 2.7. Estimate the systematic error of the pressure gauge and the random error for the fourth reading.

2. It is required to estimate the amount of cement required for casting a concrete slab. The length l was measured with a tape and the readings were 12.2, 12.7, 12.3, 12.9 and 12.4 m. The breadth b was found to be 11.2 m with an uncertainty +/-0.05 m triangularly distributed. The thickness of the slab h should be 0.125 m with expanded uncertainty +/- 0.002 m (99%). The amount of cement required per m^3 of concrete is uniformly distributed between 310 and 320 kg. Estimate the amount of cement required, and its 95% expanded uncertainty.

                                                                           (8 marks)
3. How is the instrument resolution taken into account in determining the uncertainty while using it?

4. In the US, the maximum amount of lead allowed to be present in paints on toys is 90 ppm. A manufacturer tested a sample of toys before export and found the result to be 88.5 ppm, with expanded uncertainty 2 ppm. Can the consignment be exported, if a guard band of a) 100% b) 50% is practised. Justify.

5. Explain what is meant by the Bearing Ratio curve. What is its importance?

6. How can GD&T eliminate tolerance accumulation?

7. What is wrong with the geometric tolerance in the drawing below? Explain.
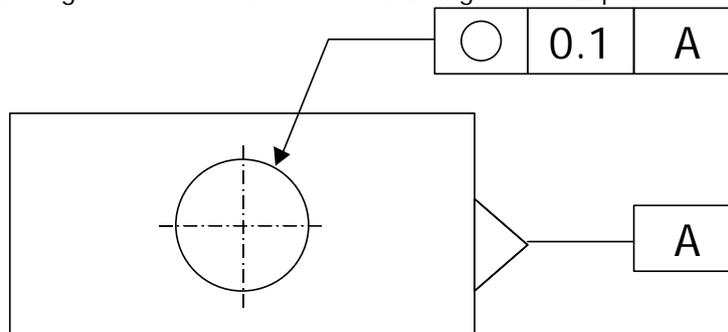
8. Determine the straightness error with respect to the end point line for the data:

x (mm)	0	100	200	300	400	500
y (µm)	4	3	6	3	2	3

9. What are the common displacement transducers used in CMMs?

10. What are the recommended steps in CMM measurement planning?

11. How many points would you recommend to sample on a plane, using a CMM? Justify.

12. Explain any one method to determine the uncertainty of CMM measurement.

13. What is Monte Carlo simulation? How can it be used to determine measurement uncertainties?

14. What do you mean by depth in a digital image? What happens when you reduce the depth?

15. Which file format uses wavelet compression? Explain the principle behind the method.

16. What is back-lighting? What is the type of image that you get with this lighting?

17. A camera with a focal length of 40 mm is used to take a photo of a building that is 12 m high and is 75 m away from the camera. Determine its height in the image in mm.

18. Determine the Euclidean, City Block, and Chessboard distances between points (20,30) and (30,50).

19. Determine the result of average filtering with a 3X3 mask on the image $\begin{bmatrix} 1 & 2 & 1 & 2 \\ 4 & 7 & 4 & 5 \\ 1 & 4 & 5 & 4 \\ 4 & 5 & 4 & 3 \end{bmatrix}$ limiting

excursions of the mask till the border.

20. Explain what do you mean by optimum threshold.

21. Determine the minimum perimeter polygon using the marked cells for the object in the image given below:
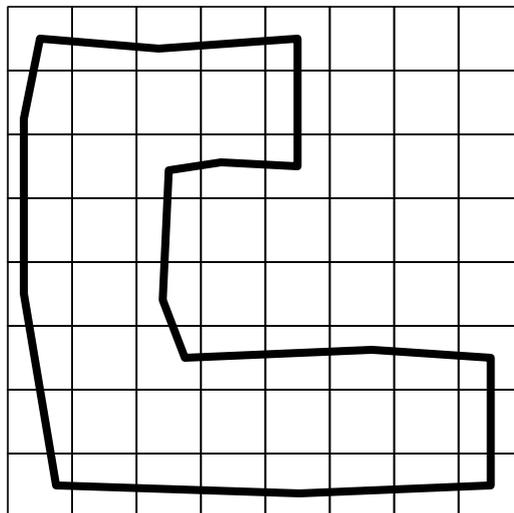
22. Explain optimum statistical classifiers.

23. a) Give one good point about this course b) Give one suggestion which you think will best improve this course.

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