

Name:.....

Roll No:.....

NATIONAL INSTITUTE OF TECHNOLOGY CALICUT
 Department of Mechanical Engineering
End Semester Examination, Nov-Dec 2008
I Semester M.Tech. – Manufacturing Technology

MEC603 ADVANCED METROLOGY AND COMPUTER AIDED INSPECTION

Time: Three hours

Maximum Marks: 50

- The Economic Order Quantity is given by the formula $Q = \sqrt{\frac{2SD}{iC}}$, where C is the Unit cost, i the Carrying rate per period, S the Cost per Order and D the Demand during the period. D is 3600 m/year normally distributed with three sigma limits between +/-100, S Rs1000/order with uncertainty uniformly distributed between +/-50, i 0.25 per year with standard uncertainty +/-0.01 having 5 degrees of freedom, C Rs500/m with uncertainty triangularly distributed between +/-10. Determine the 95% expanded uncertainty interval in determination of Q. (12 marks)
- A company makes Hawaii chappals for the local market. The length of a model is specified as 200+/-3mm. A sample was taken from a batch and its length measured as 203.4mm with expanded uncertainty 0.5mm. Is the sample acceptable using a) guard band 100% b) guard band 50%. (2 marks)
- What are the functions of software in a CMM? (2 marks)
- The results of a straightness measurement are given as (0,3), (100,7), (200,16), (300,19), (400,27) where the first number is the distance along x axis in mm and the second number deviation from a horizontal reference line in microns. Determine straightness error based on the end point line. (4 marks)
- Explain the different methods by which points can be sampled over a surface using a CMM. (3 marks)
- Differentiate between datum, datum feature and simulated datum feature. (3 marks)
- Explain the different types of sensor arrangements used in image acquisition devices. (3 marks)
- Derive expressions for the coordinates of the image produced by a pin hole camera in the simplest configuration. (3 marks)
- Determine the Euclidean, City Block and Chessboard distances between pixels a and b. (3 marks)

			b
a			

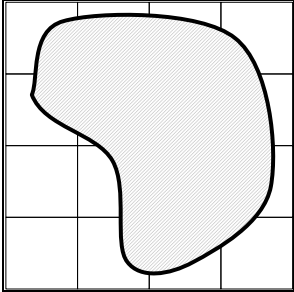
3	4	0	0
4	3	1	1
0	1	0	0
0	1	0	0

- Determine the results of an intensity transformation $s = r^2$ on the image r= if the resulting image is 3 bit. (4 marks)

11. A surface profile was obtained as a series of heights from an extrinsic datum in steps of 0.05mm as: 1, 3, 4, 8, 3, 3, 4, 6, 10, 10, 8, 2, 2, 2, 10, 9, 6, 2, 5, 7, 8, 5, 4, 1, 2 (μm). Calculate R_q assuming that the surface is well aligned with respect to the datum.

(3 marks)

12. Sketch the minimum perimeter polygon for the object in the image:



(4 marks)

13. Explain the concept of neural networks and how they are used to recognize objects in images.

(4 marks)

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

SOLUTIONS TO NUMERICALS:

$$c_s = \sqrt{\frac{D}{2iCS}} = 0.12$$

$$c_D = \sqrt{\frac{S}{2iCD}} = 0.03333$$

$$c_i = -\sqrt{\frac{SD}{2Ci^3}} = -480$$

$$c_C = -\sqrt{\frac{SD}{2C^3i}} = -0.24$$

uS	3.464102	uD	1.111111	ui	-4.8	uC	-0.979796
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			u	dof
S	1000.00	50.00	28.8675	
D	3600.00	100.00	33.3333	
i	0.25	0.01	0.0100	5
C	500.00	10.00	4.0825	
Q	240.00	m		

	S+	S-	D+	D-	i+	i-	C+	C-
	1028.8675	971.1325	1000.0000	1000.0000	1000.0000	1000.0000	1000.0000	1000.0000
	3600.0000	3600.0000	3633.3333	3566.6667	3600.0000	3600.0000	3600.0000	3600.0000
	0.2500	0.2500	0.2500	0.2500	0.2600	0.2400	0.2500	0.2500
	500.0000	500.0000	500.0000	500.0000	500.0000	500.0000	504.0825	495.9175
	243.4395	236.5105	241.1086	238.8863	235.3394	244.9490	239.0262	240.9858
uS	3.4645	uD	1.1111	ui	-4.8048	uC	-0.9798	
	37.2833							
uc	6.1060			ui^4	532.9708			
uc^4	1390.0472			ui^4/dof	106.5942			
dof	13.0406							
t	2.1604							
U	13.1912	m						
Q+	253.1912	m						
Q-	226.8088	m						

2.

Cheap product, hence relaxed acceptance

a) 100% guard band: Accept; 50% guard band: Reject

4.

Endpoint line = 3 + 0.06*x

x	y	y ²	e
0	3	3	0
100	7	9	-2
200	16	15	1
300	19	21	-2
400	27	27	0
		emax	1

		emin	-2
		sterr	3

9.

Euclidean	3.162278
City Block	4
Chessboard	3

10.

7	7	0	0
7	7	1	1
0	1	0	0
0	1	0	0

11.

1	-4	16
3	-2	4
4	-1	1
8	3	9
3	-2	4
3	-2	4
4	-1	1
6	1	1
10	5	25
10	5	25
8	3	9
2	-3	9
2	-3	9
2	-3	9
10	5	25
9	4	16
6	1	1
2	-3	9
5	0	0
7	2	4
8	3	9
5	0	0
4	-1	1
1	-4	16
2	-3	9
5		8.64
	Rq	2.939

12.

