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UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JULY 2010 SESSION

SUBJECT CODE	:	FGB 20102
SUBJECT TITLE	:	ENGINEERING METROLOGY
LEVEL	:	BACHELOR
TIME / DURATION	:	8.00pm – 10.00pm (2 HOURS)
DATE	:	18 NOVEMBER 2010

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This paper consists of FIVE (5) questions. Answer any FOUR (4) questions only.
6. Answer all questions in English.

THERE ARE 5 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.

INSTRUCTION: Answer any FOUR questions.
Please use the answer booklet provided.

Question 1

(a) Explain the meaning of:

(i) Maximum metal condition
(ii) Least metal condition
(iii) Tolerance
(iv) Allowance

Draw a neat sketch to represent these terms for a shaft and hole of clearance fit.

(10 marks)

(b) As a design engineer, you have to provide specifications of a heavy shaft , **90J7-j6** to the production manager. By referring to the IS standard given, determine:

(i) Tolerance for the shaft and hole
(ii) Type of fit according to the given shaft and hole
(iii) Sketch the limit of tolerance and allowance for the given shaft and hole

(15 marks)

Question 2

Vernier caliper is the instrument used for product inspection at your production line. After some time, a calibration engineer was asked to check the condition of the caliper. As shown in **Figure 1**, the calibration engineer was trying to check the reading using gauge block.

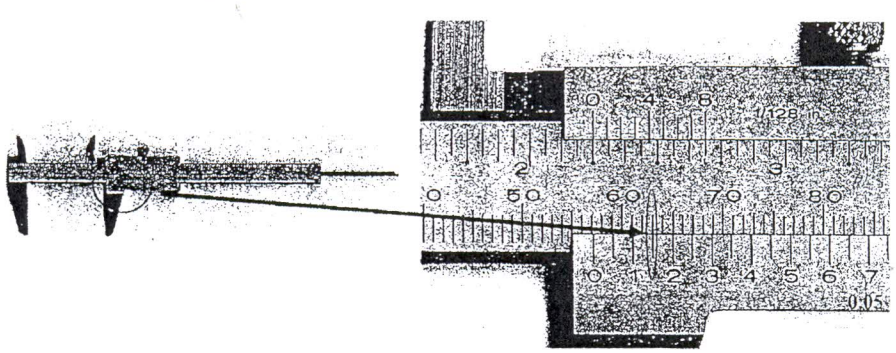

Figure 1

(a) Why is it necessary to do the calibration?

(3 marks)

(b) What is the reading for the caliper?

(2 marks)

(c) Explain a proper method how to use the gauge block in getting the reading in question (b) using **Table 1**

(15 marks)

0.001mm series-9 blocks

1.001	1.002	1.003	1.004	1.005	1.006	1.007	1.008	1.009

0.01mm series-49 blocks

1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09
1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18
1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27
1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36
1.37	1.38	1.39	1.40	1.41	1.42	1.43	1.44	1.45
1.46	1.47	1.48	1.49					

0.5mm series-1 block

0.5

0.5mm series-18 blocks

1	1.5	2	2.5	3	3.5	4	4.5	5
5.5	6	6.5	7	7.5	8	8.5	9	9.5

10mm series-9 blocks

10	20	30	40	50	60	70	80	90

Two 2mm wear blocks

Table 1: Sizes in an 88 piece set of metric gauge block

(d) Define and describe what are the gauge blocks preparation steps to make a measurement.

(5 marks)

Question 3

(a) You as a Quality Engineer at CITIES Company are responsible to perform the angular measurement of the product. The facilities that CITIES company has are Vertical optical comparator, bevel verneir protractor, sine bar, dial indicator, gauge block angle block. Briefly explain the equipment concept as listed below:

(i) Dial indicator
(ii) Bevel vernier protractor
(iii) Sine bar
(iv) Angle block

(8 marks)

(b) Based on your judgment and experiences you choose sine bar with dial indicator gauge and gauge block to measure the specified angle.

(i) Outline the measurement procedure and steps in details with the appropriate sketches for the measurement.

(15 marks)

(ii) What are the limitations of using the sine bar in angle measurement?

(2 marks)

Question 4

You will use surface roughness tester to measure the surfaces roughness of a product after the electro polish process.

(a) Name and define the necessary setting that need to be confirmed before you start the measurement. Why?

(4 marks)

(b) By using the suitable diagrams , define the terms below:

(i) Sampling length
(ii) Lay
(iii) Roughness
(iv) Waviness

(8 marks)

(c) What is the implication of the product if the measurement results represent a higher Ra?

(3 marks)

(d) In the measurement of the surface roughness, height of 20 successive peaks and troughs were measured from 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 were obtained over a length of 25mm, determine:

(i) Ra.

(ii) RMS value of the rough surface.

(10 marks)

Question 5

(a) Statistical Process control (SPC) is used to monitor the production process that will meet up standards where control chart is used. There are a lot of terms specifically used for the purpose of control chart analysis. It is important to understand the meaning of these terms while analyzing the control chart. What is **attribute data** and **variable data** ?

(5 marks)

(b) By using the below data from **Table 2,**

(i) Determine the control limits of x bar and R charts.

(ii) Draw the x bar and R chart.

(iii) Give your comments on the construct control chart.

(20 marks)

Table 2

Sample No					
1	160.0	159.5	159.6	159.7	159.7
2	159.7	159.5	159.5	159.5	160.0
3	159.2	159.7	159.7	159.5	160.2
4	159.5	159.7	159.2	159.2	159.1
5	159.6	159.3	159.6	159.5	159.4
6	159.8	160.5	160.2	159.3	159.5
7	159.7	160.2	159.2	159.0	159.7
8	159.2	159.6	159.6	160.0	159.9
9	159.4	159.7	159.3	159.9	159.5
10	159.5	160.2	159.5	153.9	159.5
11	159.4	158.3	159.6	159.8	159.8
12	159.5	159.7	160.0	159.3	159.4
13	159.7	159.5	159.3	159.4	159.2
14	159.3	159.7	159.9	158.5	159.5
15	159.7	159.1	158.8	160.6	159.1

END OF QUESTION

Appendix

The factors for constructing control charts

n	A2	D3	D4
2	1.880	0	3.267
3	1.023	0	2.574
4	0.729	0	2.282
5	0.577	0	2.114
6	0.483	0	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816