SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2014 SESSION

SUBJECT CODE	:	**FGB 20102**
SUBJECT TITLE	:	**ENGINEERING METROLOGY**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**2 HOURS**
DATE	:	

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 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer any FOUR(4) questions.

Please use the answer booklet provided.

Question 1

(a)   Define the meaning of accuracy and precision in engineering metrology.

(5 marks)

(b)   Describe the importance of accuracy and precision of collected data in working environment such as follows:

(i)   Mass production   (2 marks)

(ii)   Quality inspection   (2 marks)

(iii)   Design   (2 marks)

(c)   A hole and mating shaft are to have a nominal assembly size of 25 mm. The assembly is to have a maximum clearance of 0.25 mm and a minimum clearance of 0.15 mm. The hole tolerance is 1.5 times the shaft tolerance. Determine the limits for both hole and shaft by using:

(i)   Hole basis system   (7 marks)

(ii)   Shaft basis system   (7 marks)

Question 2

(a)   Explain the concept of limit gauging, taking the example of gauging of holes and shaft. Also list out the advantages and disadvantages of using limit gauges.

(6 marks)

(b)   Discuss about the tolerance and wear allowance in limit gauges.

(4 marks)

(c)   Design general type GO and NO GO gauges for components having **80H9-d10** fit without allowing any gauge tolerance. You also need to sketch the gauges with the values.

(15 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   (2 marks)

(ii)   Bevel vernier protractor   (2 marks)

(iii)   Sine bar   (2 marks)

(iv)   Angle block   (2 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)   Determine 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. Explain.   (4 marks)

(b)   By illustrating a suitable diagrams , please define the terms below:

        (i)   Sampling length   (2 marks)

        (ii)   Lay   (2 marks)

        (iii)   Roughness   (2 marks)

        (iv)   Waviness   (2 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 20mm, determine:

        (i)   Ra   (5 marks)

        (ii)   RMS value of the rough surface   (5 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 **p-chart** and **c-chart** ?

        (5 marks)

(b)   Referring data from **Table 1**,

     (i)   Determine the control limits of x bar and R charts   (6 marks)

     (ii)   Draw the x bar and R chart   (6 marks)

     (iii)   Give your comments on the construct control chart   (8 marks)

Table 1

Operator	1	2	3	4	5	6	7	8
Part A	85.427	85.990	85.322	85.254	85.774	84.988	85.990	85.322
Part B	85.774	85.427	84.988	85.322	84.988	85.254	85.888	85.254
Part C	85.990	85.774	84.988	85.990	85.427	85.888	84.988	85.322
Part D	85.427	85.888	85.254	85.774	85.774	85.990	85.322	85.322
Part E	85.254	85.254	85.427	84.988	85.254	85.774	85.427	85.888

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