



**UNIVERSITI KUALA LUMPUR
Malaysia France Institute**

**FINAL EXAMINATION
JANUARY 2011 SESSION**

SUBJECT CODE : FGB 20102
SUBJECT TITLE : ENGINEERING METROLOGY
LEVEL : BACHELOR
TIME / DURATION : 9.00 am – 11.00 am
(2 HOURS)
DATE : 08 MAY 2011

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.
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THERE ARE 3 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) Define terms: Clearance , interference and transition fit. Draw a diagram to represent of these terms on a shaft and hole pair. (10 marks)
- (b) The hole and shaft assembly of 90 mm nominal size have tolerances specified as $90^{+0.05\text{mm}}$ for hole and $90^{-0.03\text{mm}}$ for shaft. Determine:
- (i) Maximum and minimum clearance (inference) attainable (3 marks)
 - (ii) Hole and shaft tolerances (3 marks)
- (c) A push fit H7- k6 is required in on a shaft of 65 mm diameter. Determine proper tolerance for hole and shaft and also type of fit. (9 marks)

Question 2

- (a) What is the difference between plug gauge and ring gauge. (5 marks)
- (b) Describe what are the three slip gauge block preparation steps to make a measurement. (5 marks)
- (c) Design general type GO and NO GO gauges for components having **50H7-d10** fit with gauge tolerance. You also need to sketch the gauges with the values. (15 marks)

Question 3

- (a) Explain measurement of flatness by:
 - (i) Straight edge. (2.5 marks)
 - (ii) Optical flat. (2.5 marks)
- (b) Define the two categories in linear measurement and give two example of measuring device for each categories. (8 marks)
- (c) What are differences between “ Variation in measurement “ and “Errors in measurement”. Explain. (6 marks)
- (d) Name any three of the Geometrical Dimensional (GD&T) and show the position of measurement tolerance together with the used geometric symbol. (6 marks)

Question 4

- (a) Explain terms R_a and R_z values. (5 marks)
- (b) Sketch a geometric symbol for surface roughness and define each term . (7 marks)
- (c) Handy surf stylus machine is used to measure the surface roughness of a product after the turning process. Name and define the parameters that need to confirmed before starting the measurement . Why? (5 marks)
- (d) In the measurement of surface roughness for a turning shaft of four stroke engine, the following data have have been collected:

Y,um	35	25	40	22	35	18	42	25	25	22	36	18
Ordinat	1	2	3	4	5	6	7	8	9	10	11	12

Determine:

- (i) R_a
- (ii) RMS

(8 marks)

Question 5

- (a) The inspection results of a part dimension using a micrometer and a vernier caliper are enlist in Table 1. Number of parts inspected for ten (10) sample size is four (4). For each instrument:
- (i) Determine the control limits of \bar{x} bar and R charts (10 marks)
 - (ii) Draw the \bar{x} bar and R chart (10 marks)
- (b) From the chart, discuss the vernier caliper and micrometer capability of measuring dimension in relation to its accuracy and precision. (5 marks)

Table 1: Dimension of Parts measured using Micrometer and Vernier Caliper

No of Subgroup	Vernier Caliper		Micrometer	
	\bar{X} (mm)	R (mm)	\bar{X} (mm)	R (mm)
1	49.80	0.02	49.800	0.002
2	49.80	0.02	49.790	0.010
3	49.82	0.04	49.792	0.008
4	49.82	0.02	49.800	0.002
5	49.82	0.02	49.794	0.006
6	49.82	0.02	49.792	0.008
7	49.80	0.02	49.792	0.008
8	49.80	0.02	49.784	0.016
9	49.82	0.02	49.789	0.011
10	49.82	0.02	49.778	0.022

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