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10ME/AU32B

Third Semester B.E. Degree Examination, December 2011
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Draw neat sketches wherever required.

PART – A

1 a. Sketch and explain the following :
Imperial standard yard and international prototype meter. **(08 Marks)**

b. Compare line and end standards of measurements. **(06 Marks)**

c. Three 100mm end bars are measured on a level comparator by first wringing them together and comparing with a 300 mm bar. The 300 mm bar has a known error of +40 μm and the three bars together measure 64 μm less than the 300 mm bar. Bar A is 18 μm longer than bar B and 23 μm longer than bar C. Find the actual length of each bar. **(06 Marks)**

2 a. Explain :
i) Interchangeable manufacturing.
ii) Selective assembly of machine parts. **(05 Marks)**

b. Design a general type Go and No Go gauges for a hole and shaft pair designated as 450 H_8e_9 with following details :
i) 450 mm dia lies in 400 – 500 mm step.
ii) The standard tolerance unit i is given by the formula $i = 0.45\sqrt[3]{D} + 0.001D$ microns (D is in mm).
iii) IT8 = 25i, IT9 = 40i.
iv) The fundamental deviation for an e type shaft = $-11D^{0.41}$ microns.
Sketch the layout indicating the various tolerance on both holes and shaft and their respective gauges. **(15 Marks)**

3 a. What is a comparator, what are the needs and characteristics of comparator? **(06 Marks)**

b. Explain with a neat sketch the working principle of Johansson Mikrokator. **(10 Marks)**

c. List the advantages and disadvantages of mechanical comparators. **(04 Marks)**

4 a. With a neat sketch, explain the working principle of an auto collimator. **(06 Marks)**

b. Mention the nominal angles of a standard set of angle gauges and indicate how the following angles can be built using angle gauges i) 33°16'42" ; ii) 57°34'9". **(06 Marks)**

c. Define "effective diameter and "best size wire". Derive an expression to determine the best size wire diameter. **(08 Marks)**

PART – B

5 a. Define measurement with the aid of a block diagram, explain the three stages of a generalized measurement system with suitable example. **(10 Marks)**

b. Define error in measurement. Give classification of errors. **(04 Marks)**

c. Define the following :
i) Accuracy ; ii) Precision ; iii) Sensitivity. **(06 Marks)**

6 a. What is a transducer? Differentiate between
i) Primary and secondary transducers.
ii) Active and passive transducers. **(06 Marks)**

b. With a neat block diagram, explain the working principle of CRO. **(10 Marks)**

c. State the advantages of electrical signal conditioning elements. **(04 Marks)**

7 a. Explain with a neat sketch the working principle of McLeod gauge. **(08 Marks)**

b. Explain with a neat sketch the working principle of a Pirani gauge. **(06 Marks)**

c. Explain with suitable diagram the working of hydraulic dynamometer. **(06 Marks)**

8 a. What is a thermo couple? State the laws of thermocouple and explain the same. **(06 Marks)**

b. Derive an expression for gauge factor of a strain gauge. Why gauge factor is at least two for most of the materials? **(06 Marks)**

c. Explain the working principle of optical pyrometer, with a neat sketch. **(08 Marks)**

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