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06ME42B

Fourth Semester B.E. Degree Examination, December 2012
Mechanical Measurements and Metrology

Time: 3 hrs.

Max. Marks:100

**Note: Answer FIVE full questions, selecting
at least TWO questions from each part.**

PART – A

1.
 - a. Define metrology. Differentiate between line standard and end standard, with examples. (08 Marks)
 - b. Four length bars A, B, C and D, each having a basic length of 250 mm are to be calibrated using a calibrated length bar of 1000 mm basic length. The 1000 mm bar has an actual length of 999.9991 mm. Bar 'B' and bar 'C' are longer than bar 'A' by 0.0001 mm and 0.0005mm respectively. But bar 'D' is shorter than bar 'A' by 0.0002 mm. It is also seen that $L_A + L_B + L_C + L_D = L + 0.0003$ mm. Determine the lengths of bars A, B, C and D. (08 Marks)
 - c. Give the details of M112 slip gauges and build the dimension 137.7395 mm. (04 Marks)

2.
 - a. Briefly explain the shaft basis and hole basis system of assigning fits to the components. (06 Marks)
 - b. Determine the actual dimensions to be provided for a shaft and hole of 70 mm size for H_8d_9 fit type. Size 70 mm lies in diameter steps of 50-80 mm. Value of tolerance unit $i = 0.45\sqrt[3]{D} + 0.001D$ microns. Value of tolerance for IT8 and IT9 grades are $25i$ and $40i$ respectively. Value of fundamental deviation for 'd' shaft is given by $-16D^{0.44}$ microns. Represent schematically. (08 Marks)
 - c. With neat sketches, explain the types of fit. (06 Marks)

3.
 - a. What is a comparator? Briefly explain with a neat sketch, the principle of operation of sigma comparator. (08 Marks)
 - b. With a neat sketch, explain the back pressure type of pneumatic comparators. (06 Marks)
 - c. Write a note on angle gauges and build the angle $35^\circ 32' 36''$. (06 Marks)

4.
 - a. Explain with neat sketches, how you would measure i) Minor diameter of an internal thread and ii) Major diameter of an external thread. (08 Marks)
 - b. Define "effective" diameter. Derive an expression for measuring the "effective" diameter of a metric thread by using the "2-wire" method. (08 Marks)
 - c. Write a note on optical flats. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

PART – B

- 5 a. What do you understand by the term “measurement”?
Define the terms: i) Accuracy ii) Calibration iii) Loading effect iv) System response. (06 Marks)
- b. What is a “transducer”? With the help of neat sketches explain the various types of pressure sensitive elements used as mechanical transducers. (08 Marks)
- c. What is ‘error’? Explain the classification of errors. (06 Marks)
- 6 a. Enumerate the importance of intermediate modifying devices. Explain the inherent problems in a mechanical system. (08 Marks)
- b. Explain the ballast circuit and indicate its input-output relationship. (06 Marks)
- c. With a neat sketch, explain the working principle of a CRO. (06 Marks)
- 7 a. Derive an expression for measuring “sensitivity” of an analytical balance. (08 Marks)
- b. Sketch and explain the working of a hydraulic dynamometer. (06 Marks)
- c. Describe with a neat sketch the McLeod vacuum gauge. (06 Marks)
- 8 a. With a neat sketch, discuss the construction and working of an optical pyrometer. (08 Marks)
- b. Explain the laws of thermocouple. (06 Marks)
- c. What is a strain gauge? Differentiate between wire type and foil type strain gauges, with neat sketches. (06 Marks)

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