CBCS SCHEME

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18AE36

Third Semester B.E. Degree Examination, July/August 2021
Measurements and Metrology

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. Four end bars of basic length 100 mm are to be calibrated using a standard bar of 400 mm whose actual length is 399.9992 mm. It was found that lengths of bars B, C and D in comparison with A are +0.0002 mm, +0.0004 mm and –0.0001 mm respectively, and the length of all the four bars put together in comparison with the standard bar is +0.0003 mm longer. Determine the actual lengths of each end bars. **(08 Marks)**

b. Explain International Prototype Meter with neat sketch. **(08 Marks)**

c. Build 49.3825 mm using M-87 set slip gauges. **(04 Marks)**

2 a. Three 100 mm end bars are measured on a level comparator by first wringing them together and comparing with a calibrated 300 mm bar which has a known error of +40 mm. The three end bars together measure 64 mm less than the 300 mm bar. Bar A is 18 mm longer than bar B and 23 mm longer than bar C. Find the actual length of each bar. **(08 Marks)**

b. Build 78.3665 mm using M112 set slip gauges. **(04 Marks)**

c. Explain Imperial Yard Meter with neat sketch. **(08 Marks)**

3 a. Determine the tolerances on the hole and shaft for a precision running fit designated by $50H_7g_6$. It is considered that 50 mm lies between 30-50 mm. Fundamental deviation for 'H' hole is 'o' and 'g' shaft is $-2.5D^{0.34}$. Also JT7 = 16i and IT6 = 10i. State the actual maximum and minimum sizes of the hole and shaft and maximum and minimum clearances. **(08 Marks)**

b. Explain the concept of interchangeability and selective assembly in metrology. **(06 Marks)**

c. Explain the concepts of hole basis and shaft basis system in terms of assembly fir specifications. Which of the two is preferred and why? **(06 Marks)**

4 a. Design the general type 'GO' and 'NO GO' gauges for the component having $25H_7f_8$ fit. Given 25 mm falls in the diameter step of 18-30 mm. Upper deviation for 'f' shaft is given by $-5.5D^{0.41}$. Also determine the type of fit and allowance for the fit taking IT7 = 16i and IT8 = 25i. **(10 Marks)**

b. Explain Ring gauge and Plug gauge with neat sketch. **(10 Marks)**

5 a. Explain the construction and working principle of Johannson Mikrokator with neat sketch. **(08 Marks)**

b. With neat sketch, explain the working principle of sine bar. **(06 Marks)**

c. Select the sizes of angle gauges required to build 37°16′42″ and 102°8′42″. **(06 Marks)**

6 a. Derive an expression for measurement of effective diameter for 2 wire method of screw thread measurement. **(10 Marks)**

b. Derive an expression to determine the tooth thickness for a screw thread using gear tooth vernier. **(10 Marks)**

7 a. Define transfer efficiency of a transducer. Explain with an example primary and secondary transducers. **(08 Marks)**
b. Explain Bourdon tubes and Diaphragms with neat sketch. **(06 Marks)**
c. Explain the working principle of capacitive transducers. With neat sketch, explain the capacitive transducer working with changing distance phenomenon. **(06 Marks)**

8 a. Define error. Give the details classification of errors. **(08 Marks)**
b. Discuss the block diagram of generalized measurement system. **(08 Marks)**
c. Define the terms accuracy, response time delay, threshold and calibration. **(04 Marks)**

9 a. With neat sketch, explain hydraulic dynamometer. **(10 Marks)**
b. Explain the working principle of McLeod gauge. Also determine an expression for unknown pressure using McLeod gauge. **(10 Marks)**

10 a. Define thermocouple. State and explain the laws of thermocouples. **(06 Marks)**
b. Describe the construction and working of optical pyrometer with neat sketch. **(07 Marks)**
c. Derive an expression to determine the gauge factor for a given strain gauge with length 'L' and area of cross-section 'A'. **(07 Marks)**

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