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18AE36

Third Semester B.E. Degree Examination, June/July 2024
Measurements and Metrology

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Define the terms Metrology and Measurement. State and explain the objectives of Metrology.
          (10 Marks)

   b. With a neat sketch, explain :
     i) Imperial standard yard   ii) International Prototype meter.   **(10 Marks)**

OR

2 a. Briefly explain the characteristics , advantages and disadvantages of Line standard , End standard and Wave length standards.   **(10 Marks)**

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

    ii) Using M112 set of slip gauges build the following dimensions :
       i) 49.3115   ii) 68.208.

Range (mm)	Steps (mm)	Pieces
1.001 to 1.009	0.001	09
1.01 to 1.49	0.01	49
0.5 to 24.5	0.50	49
25,50,75,100	25	04
1.0005	-	01

                                                  (04 Marks)

Module-2

3 a. i) Differentiate between Unilateral and Bilateral tolerances. Why Unilateral tolerance is preferred over bilateral tolerance.   **(06 Marks)**

    ii) Write a note on : i) Compound Tolerances   ii) Interchangeability.   **(04 Marks)**

   b. With a neat sketch, explain the various types of Fits.   **(10 Marks)**

OR

4 a. i) Discuss the hole based and shaft based system of fits. Which is preferred and why?   **(06 Marks)**

    ii) What are Limit gauges? Explain any two types of plain plug gauges.   **(04 Marks)**

   b. Determine the tolerance on the hole and the shaft for a precision machine fit designated by $50H_7g_6$. Given i) 50mm lies between 30 – 50mm.

    ii) $i(microns) = 0.45 (D)^{1/3} + 0.001D$ iii) Fundamental deviation for 'H' hole = 0.

    iv) Fundamental deviation for shaft 'g' = $-2.5D^{0.34}$.

    v) $IT_7 = 16\,i$ vi) $IT_6 = 10\,i$.

    State the actual max. and min. sizes of the hole and shaft and max. & min. clearances.

                                                  (10 Marks)

Module-3

5 a. With a neat sketch, describe the Construction and working of Sigma Comparator. **(10 Marks)**
   b. How do you find the effective diameter of a screw thread using 2 – wire method? **(10 Marks)**

OR

6 a. i) Describe with a neat sketch Construction and working of LVDT. **(06 Marks)**
      ii) List the advantages and disadvantages of Optical comparator. **(04 Marks)**
   b. i) With a sketch, explain the method of measuring Taper angles using Sine centre.

(06 Marks)

      ii) Give the combination of angle gauges to obtain the following angle, also sketch the arrangement of gauges : 37° 16′ 42″. **(04 Marks)**

Module-4

7 a. Explain with an example the various stages of a generalized Measurement system. **(10 Marks)**
   b. Define and state the significance of following terms in measurement :
      i) Accuracy   ii) Precision   iii) Sensitivity   iv) Repeatability
      v) Loading effect. **(10 Marks)**

OR

8 a. Define Error. Give the detailed classification of errors in Measurement and also state the factors responsible for the above errors. **(10 Marks)**
   b. i) Explain briefly the various types of Mechanical Transducer elements. **(05 Marks)**
      ii) With a sketch, explain the working principle of an electronic transducer. **(05 Marks)**

Module-5

9 a. What is Dynamometer? With a sketch, explain the working principle of hydraulic dynamometer. **(10 Marks)**
   b. What is Thermocouple? Explain the laws of Thermocouple. **(10 Marks)**

OR

10 a. With a neat sketch, explain the measurement of low pressure by Mc Leod gauge. **(10 Marks)**
   b. Explain with a neat sketch, any one mechanical type strain gauge, also list their advantages and disadvantages. **(10 Marks)**

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