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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Mechanical Engineering

Semester End Examination; June - 2017

Mechanical Measurements and Metrology

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Assume missing data if any.

UNIT - I

1 a. With the help of graph, explain how increase in accuracy affects cost. 4

b. Discuss the various static characteristics associated with a measuring instrument. 10

c. Discuss the two broad categories of errors that occur in measurements. 6

2 a. Discuss the process of transfer from line standard to end standard. 10

b. Define wave length standard and describe its significance. 4

c. A calibrated meter end bar, which has an actual length of 1000.0005 mm, is to be used in the calibration of two bars X and Y each having a basic length of 500 mm. When compared with the metre bars, the sum of L_x and L_y is found to be shorter by 0.0003 mm. When X and Y are compared, it is observed that X is 0.0004 mm longer than Y. Determine the actual lengths of X and Y. 6

UNIT - II

3 a. Write any four differences between tolerance and allowance. 4

b. With an example explain the concepts of progressive dimensional to overcome accumulation of tolerances: 6

c. A clearance fit has to be provided for a shaft and bearing assembly having a diameter of 40 mm. Tolerances on hole and shaft are 0.006 and 0.004 mm respectively. The tolerances are disposed unilaterally. If an allowance of 0.002 mm is provided, find the limits of size for hole and shaft when 10

i) Hole basis system ii) Shaft basis system are used

Also the disposition of tolerances.

4 a. Define geometric tolerances? How are they specified? 4

b. With a schematic diagram discuss maximum and minimum metal limits of hole and shaft. 6

c. Design a general type of GO & NO GO gauges for a 40mm shaft- hole pair designated as 40 H8 d9 given that

i) Fundamental tolerance unit i = 1.571 microns

ii) upper deviation of shaft = $- 1.6D^{0.44}$.

Contd….2

iii) Hole tolerance = 0.039 mm and shaft tolerance = 0.063 mm

iv) Wear allowance = 10% gauge tolerance. 10

v) 40 mm lies in the diameter range of 30-50 mm.

UNIT - III

5 a. With a neat sketch explain how the input signal is magnified in two stages in the sigma mechanical comparator. 8

b. Discuss the inspection of conical work pieces using a sine centre. 6

c. Describe the working of solex comparator with a neat sketch. 6

6 a. Explain briefly the various methodologies used to assess surface quality. 9

b. Discuss the working principle of Auto collimator. 6

c. A metric screw thread is being inspected using the two-wire method in order to measure its effective diameter and the following data is generated. Pitch = 1.25 mm, diameter of the best size wire = 0.722 mm and the mean distance over the wires = 25.08 mm. Determine the effective diameter of the screw thread. 5

UNIT - IV

7 a. Discuss the following transducers with schematic diagrams

(i) Active and passive transducers 8

(ii) Direct and Indirect transducers

b. Derive an expression to show that in the ballast circuit, maximum sensitivity is obtained, when the ballast resistance is equal to the gauge resistance. 7

c. With a circuit diagram, explain a single stage amplifier. 5

8 a. Describe the basic telemetering system with a neat diagram. 10

b. Discuss the following:

(i) Working of CRO 10

(ii) Oscillograph

UNIT - V

9 a. Define & derive an expression for Gauge factor. 8

b. With a neat sketch explain the working of Hydraulic dynamometter. 8

c. Discuss how elastic members are used for the measurement of pressure. 4

10 a. With a neat sketch explain the working of McLeods's gauge. 8

b. Describe total radiation pyrometer with a neat sketch. State its advantages. 8

c. Write a note on the preparation and mounting of strain gauges. 4

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