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

*(An Autonomous Institution affiliated to VTU, Belgaum)*

**Fourth Semester, B.E., - Mechanical Engineering**

**Semester End Examination; June - 2016**

**Mechanical Measurements and Metrology**

*Time: 3 hrs*          *Max. Marks: 100*

*Note: Answer **FIVE** full questions, selecting **ONE** full question from each **unit**.*

## UNIT - I

1 a. List different objectives of Metrology and measurements.    6

   b. Discuss the different reasons for the occurrence of systematic errors.    10

   c. Define inspection and explain the need for the same.    4

2 a. List the characteristics of end standards.    6

   b. Discuss the procedure for the transfer of line standards to end standards.    6

   c. Three 200 mm end bars P, Q and R are measured by first weighing them together and comparing with a 600 mm bar. They are then intercompared. The 600 mm bar has a known error of 40 µm and the combined length of the three end bars is found to be 64 µm less than the 600 mm bar. It is also observed that bar P is 18 µm longer than bar Q and 23 µm longer than Bar S. Determine the lengths of the three end bars.    8

## UNIT - II

3 a. Describe compound tolerance with an example.    4

   b. Explain different types of geometric tolerances and symbolically represent them.    12

   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 shaft basis system is used.    4

4 a. Design the general type of GO and NO GO gauge for components having 30 $H_7/f_8$ fit. Given that,

   i) $i = 0.45\sqrt[3]{D} + 0.001D$

   ii) Upper deviation of 'f' shaft = $-5.5D^{0.41}$    15

   iii) 30 mm falls in diameter steps of 18-30 mm

   iv) IT 7 = 16i and IT8 = 25i

   v) Wear allowance = 10% gauge tolerance.

   b. List the different points that have to be considered in the design of gauges.    5

## UNIT - III

5 a. Describe with a neat sketch how the input signal is magnified in two stages by a sigma mechanical comparator.    8

  b. Explain with a neat sketch a pneumatic gauge used for inspection of internal dimensions.    6

  c. Explain the influence of increase in the angle of measurement on accuracy while using sinbar.    6

6 a. Explain the different methods of quantifying the surface roughness.    9

  b. With the help of a heat sketch describe Tomlinson surface meter.    7

  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 distance over the wires = 25.08 mm. Determine the effective diameter of the screw thread.    4

## UNIT - IV

7 a. With an example explain a primary-secondary transducer.    4

  b. List different quality attributes of transducers.    6

  c. Define kinematic linearity and discuss the problems that limit the use of mechanical in intermediate modifying devices.    10

8 a. Show that an optimum value is obtained when the ballast resistance is equal to the gauge resistance is a ballast circuit.    8

  b. Explain a single stage electronic amplifier with a neat circuit.    6

  c. With a block diagram explain a general purpose CRO.    6

## UNIT - V

9 a. Define gauge factor. Explain its importance. Deduce an expression for the gauge factor.    10

  b. With a neat sketch explain the working of the hydraulic dynamometer.    10

10 a. Describe how vacuum pressure can be measured by applying Boyle's Law.    8

  b. Discuss the following :

  (i) Pirani Gauge

  (ii) Laws of thermo couple    12

  (iii) Optical pyrometer.

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