2014

Metrology & Measurement

Time Alloted : 3 Hours *Full Marks : 70*

The figure in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP - A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following: 10x1=10

   i) The measurement of a quantity

      a) is an act of comparison of an unknown quantity with another quantity

      b) is an act of comparison of an unknown quantity with a known quantity whose accuracy may be known or may not be known

      c) is an act of comparison of an unknown quantity with a predefined acceptable standard which is accurately known

      d) none of these.

   ii) A null type of instrument as compared to a deflection type instrument has

a) a higher accuracy

b) a lower sensitivity

c) a faster response

d) all of these

iii) If x be half the include angle of thread and p its pitch, then best size wire's diameter for measurement of effective diameter of thread is

a) (p/2)sec x

b) pcos(x/2)

c) (p/2) cos(x/2)

d) (p/2)sec(x/2)

iv) Semi -conductor thermometers have the disadvantage that they

a) are not readily available and are expensive

b) are fragile and have low sensitivity

c) are large in size and have a poor frequency response

d) none of these.

v) Example of a capacitive sensor is:

a) LVDT

b) Load Cell

c) Proximity Sensor

d) none of the above

vi) Find out the Dynamic property of the instrument from the following:

a) Sensitivity

b) Fidelity

c) Speed of response

d) Both Fidelity & Speed of response

vii) Standard can be classified in

a) 3 ways

b) 2 ways

c) 4 ways

d) none of the above

viii) Name of the control system using Feed Back path is:

a) Open loop

b) closed loop

c) Both open & closed loop

d) none of the above

ix) How many types of feedback are there:

a) 2 types

b) 3 types

c) 4 types

d) none of the above

x) Radiation pyrometers are used in the temperature range of

a) 0°C - 500°C

b) 500°C - 1000°C

c) - 250°C - 500 °C

d) 1200°C - 2500°C

GROUP - B
(Short Answer Type Questions)

Answer any *three* of the following. 3x5=15

2. What is transducer ? Explain the active transducer and passive transducer.

3. Explain why it is not preferable to use Sine bar for measuring angle more than 45° .

4. Define line standard. What is the difference between line standard and end standard? Give examples of these two types of standards.

5. What do you mean by Static characteristics of an instrument? Explain properly each of those Static characteristics of instrument?

6. What do you mean by "Load Cell"? With the help of a suitable Circuit diagram explain its operation?

GROUP - C
(Long Answer Type Questions)

Answer any *three* of the following 3x15=45

7. a) What are the different methods of measuring angles?

   b) How do you calibrate a precision polygon?

   c) A 125mm sine bar is to be set up to an angle of 30°. Estimate the error in the angle, if:

      i) distance between rollers is not correct by ± 0.005mm.

      ii) dia. of rollers is out by ± 0.002mm.

      iii) the error of parallelism between top surface and line joining centers of rollers is ± 0.002mm.

      iv) all the three errors exist simultaneously.

   (2+3)+(2½ x 4)

8. a) Explain with neat sketches the construction and principle of working of a LVDT.

   b) The output of a LVDT is connected to a 4V voltmeter through an amplifier whose amplification factor is 500. An output of 1.8 mV appears across the terminals of LVDT, when the core moves through a distance of 0.6 mm, if the milli-voltmeter scale has 100 division and the scale can be read up to 1/4 of division, calculate

i) the sensitivity of LVTD

ii) the resolution of the instrument in mm.

8+(3+4)

9. a) With a neat sketch, illustrate how the effective diameter of a screw thread may be checked using 2-wire system. What do you understand by Virtual Effective Diameter of a screw thread?

b) What are the various methods for measuring gear tooth thickness? Determine the gear tooth vernier caliper settings to measure the gear tooth thickness.

c) How do you use the property of interference of light to check the height of gauge block?

(4+2)+(2+4)+3

10. a) What do you mean by Feedback?-How many types of Feedback are there? Draw the simple block diagram of a negative feedback amplifier and derive the expression of gain with feedback.

b) What is the difference between primary texture and secondary texture? Describe the various methods of measuring surface roughness.

8+7

1. a) In the measurement of surface roughness heights of 25 successive peaks and troughs were measured from the datum and were 35, 25, 35, 35, 40, 22, 35, 18, 42, 25, 35, 22, 36, 18, 42, 22, 32, 21, 37, 18, 35, 20, 32, 18 and 40. If the sampling length is 25 mm determine C.L.A and R.M.S. value.

b) A displacement transducer with a shaft stroke of 3.0 inch is applied to the circuit. The total resistance of the potentiometer is 5 kΩ. The applied voltage V_i is 5V. When the wiper is 0.9 inch from B. What is the value of the output Voltage?

8+7