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2013

METROLOGY & MEASUREMENTS

Time Allotted : 3 Hours | *Full Marks* : 70

The figures 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 : $10 \times 1 = 10$

i) Which of the following can be measured by LVDT ?

a) Displacement b) Velocity

c) Acceleration d) Any of these.

ii) Bevel protractor is used for

a) Angular measurement

b) Linear measurement

c) Height measurement

d) Flatness measurement.

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iii) Accuracy of setting a sine bar

a) is poor for smaller angles

b) is maximum when angle of measurement is 45°

c) decreases appreciably with steep angle

d) is dependent on accuracy of outer dimensions of sine bar.

iv) The most important characteristic of a measuring instrument, in general is

a) accuracy

b) sensitivity

c) repeatability

d) precision.

v) Gear tooth vernier is used to measure

a) gear tooth profile

b) gear tooth thickness

c) pitch line thickness of gear tooth

d) module.

vi) In limits and fits, the term 'Allowance' usually refers to

a) difference between maximum size and minimum size of the shaft

b) difference between maximum size and minimum size of a hole

c) maximum clearance between shaft and hole

d) minimum clearance between shaft and hole

e) none of these.

vii) Expressing a dimension as 15.2 + 0.00, – 0.01 mm is the case of

a) limiting dimensions b) unilateral tolerance

c) bilateral tolerance d) none of these.

viii) The least count of a vernier caliper having 25 divisions on vernier scale, matching with 24 divisions of main scale (1 main scale divisions = 0.5 mm) is

a) 0.05 mm b) 0.01 mm

c) 0.02 mm d) 0.001 mm.

ix) The maximum amount by which the result differs from the true value is called

a) correction b) discrepancy

c) error d) accuracy.

x) Two slip gauges in precision measurement are joined by

a) Assembling b) Sliding

c) Adhesion d) Wringing.

GROUP – B
(Short Answer Type Questions)
Answer any *three* of the following. 3 × 5 = 15

2. What is the difference between sensitivity and range ? What is the disadvantages of a very sensitive instrument ? 3 +

3. Discuss several types of tolerance and fit. 2 +

4. A Vernier scale consists of 25 divisions on 12 mm spacin and the main scale has 24 divisions on 12 mm. What is th least count ? Define relative error, random error an systematic errors. 2 + 1 + 1 +

State the principles of force measurement.

What is the difference between precision and accuracy ?

What is surface roughness ? 4 + 1

GROUP – C
(Long Answer Type Questions)
Answer any *three* of the following. 3 × 15 = 45

a) Explain the terms 'Tolerance', 'Allowance' and 'Fit'. Why is Hole basis of fit preferred ?

b) Determine the actual dimensions to be provided for shaft of 90 mm size for $H8/e9$ type of fit. Size 90 mm falls in the diameter steps of 80 and 100 mm. With usual notations, take $i = 0.45 (D)^{1/3} + 0.001 D$ microns, $IT\,8 = 25\,i$, $IT\,9 = 40\,i$, fundamental deviation for 'e' type shaft = $- 11D^{0.45}$ microns.

c) Design a snap gauge for checking the above shaft as per the new British system of design. 3 + 8 + 4

a) What is an optical flat ? What are the typical dimensions of an optical flat ? What care are to be taken in using the optical flat ?

b) Sketch and interpret the different patterns intererance bands observed through optical flats for following :

i) A perfectly flat surface

ii) A convex surface

iii) A concave surface. 9

9. a) Describe a dynamical method of determining the rad of arc of a concave surface.

b) Explain different types of errors in measurement w examples. 8

10. Write short notes on any *three* of the following : 3

a) Temperature measurement by thermocouple

b) Radius & filler gauges

c) Spirit level

d) Taylor-Hobson Tally surf

e) Orifice meter.

a) What is a comparator ? What are the advantages of electrical transducers over the mechanical transducers ?

b) What is dial indicator ? Explain the working principle of a dial indicator with a suitable sketch. 7 + 8