

ENGINEERING METROLOGY

Time Allowed: 3 Hours

Full Marks: 60

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 marks is allotted for right answer and 1 marks is allotted for correct explanation of the answer. However, no marks will be given for wrong explanation of the answer of each MCQ type question.

Answer any Five (05) Questions from Group-B.

GROUP-A

1. Choose the correct answer from the given alternatives and explain your answer (any ten): 2x10=20
- i) The principle of 'Interchangeability' is normally employed for –
 (a) Mass production (b) Production of identical parts
 (c) Parts within the prescribed limits of sizes (d) all of the above
 - ii) Forced or pressed fit is an –
 (a) Clearance fit (b) Interference fit (c) Transition fit (d) None of these
 - iii) a basic shaft is one whose –
 (a) Upper and lower deviation is zero (b) Upper deviation is zero
 (c) Lower deviation is zero (d) None of these
 - iv) The least count of a vernier bevel protractor is –
 (a) 5 min (b) 10 second (c) 5 second (d) 10 min
 - v) A Sin bar is used for – a) length measurement b) Angle measurement c) Radius measurement d) None
 - vi) The sensitivity of a spirit level depends on
 (a) The width of the bubble (b) accuracy of base plate
 (c) both (a) and (b) (d) the radius of curvature of the bubble tube
 - vii) According to Indian standard, total numbers of tolerance grades are-
 a) 8 b) 12 c) 18 d) 20
 - viii) Autocollimators is related with---
 a) Straightness measurement b) length measurement c) radius measurement d) none
 - ix) The instrument used for comparing the dimensions of components with a standard of length is---
 a) Inclinator b) protector c) micrometer d) comparator
 - x) The amount by which the actual size of a shaft is less than the actual size of the mating hole in an assembly
 (a) Clearance (b) Interference (c) Allowance (d) None of these
 - xi) For manufacturing a certain hole, maximum and minimum hole sizes were found to be 50.14 mm and 49.98 mm respectively. Tolerance in mm will be---
 a) 0.12 b) 0.13 c) 0.16 d) 0.20
 - xii) The following is used to check the diameters of holes –
 (a) Plug gauge (b) Ring gauge (c) Slip gauge (d) Standard screw pitch gauge
 - xiii) 'GO' and 'NO GO' gauge is a type of
 (a) Plug gauge (b) slip gauge (c) ring gauge (d) limit gauge
 - xiv) Which of the following comparators can give amplification of up to 50,000?
 (a) LVDT (b) Solex pneumatic gauge
 (c) Dial gauge (d) Sigma electronic comparator
 - xv) The instrument which has all the features of try square, bevel protector, rule and scriber, is---
 a) Outside micrometer b) inside micrometer c) depth gauge micrometer d) combination set

GROUP-B
Answer any Five (05) questions.

2. Design a plug and ring gauge to control the production of a 90 mm shaft and hole part of IT8-25/ IT9-40/
- $i = 0.45\sqrt{D} + 0.001D$
 - The upper deviations for 'e' shaft = -11μ
 - The value for standard tolerance grade IT8-25/ and IT9-40/
 - 90 mm lies in the diameter step of 80 mm and 100 mm

(8)

3. (a) What is Interchangeability?

(b) Sketch a Vernier Height gauge and explain its working principles.

(2+6)

4. (a) A slip gauge set with 87 pieces, as under is available-

(3+5)

Range (mm)	Step(mm)	No of Blocks
1.001-1.009	0.001	9
1.01-1.49	0.01	49
0.5- 9.5	0.5	19
10-90	10	9
1.005	-	1

A 100 mm Sine bar is to be set up to angle of 33° , Determine the slip gauges needed from 87 pieces set.

b) Build the following dimensions with minimum number of slip gauges i) 38.587 mm ii) 56.356 mm

5. (a) What is meant by 'hole basis system' and 'shaft basis system'? Which system is preferred and why?
(b) The tolerances for a hole and shaft assembly having a nominal size of 40 mm are as follows:

$$\text{Hole} = 40^{+0.021}_{+0.000} \text{ mm and shaft} = 40^{-0.040}_{-0.075} \text{ mm}$$

Determine (i) maximum and minimum clearances (ii) tolerances on shaft and hole (iii) allowance (iv) MML of hole and shaft (v) type of fit.

(2+1+5)

6. (a) With the help of a neat sketch, describe the construction and working of a gear tooth Vernier caliper.

(b) The following data is available for the measurement of chordal thickness of a gear having an involute profile: the number of teeth = 32, addendum circle diameter = 136 mm, and pressure angle = 20° . Determine the chordal height to which the gear tooth caliper should be set during measurement. (5+3)

7. (a) What is Comparator? How they are classified? <https://www.wbsctonline.com>

(b) Explain with a neat sketch the working principle of Bevel Protector.

(1+2+5)

8. (a) What are the differences between the "Line standard" and "End standard"?

(b) With neat sketch show the following terminology of a screw thread: nominal diameter, core diameter, effective diameter, pitch, crest, root, and pitch line.

(3+5)

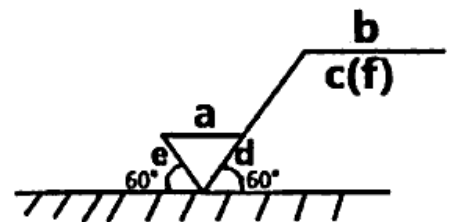
9. (a) Define fit and explain in brief the different types of fits.

(4+4)

(b) Built up the angular dimension $33^\circ 10' 12''$ with the help of following standard angle gauge $[1^\circ, 3^\circ, 9^\circ, 27^\circ, 41^\circ] [1', 3', 9', 27'] [3'', 6'', 18'', 30'']$

10. a) What does the drawing indicate as shown in following figure?

(b) With neat sketch show the following gear terminology of a spur gear: circular pitch, base circle, pitch circle, addendum circle, and tooth thickness.



(4 + 4)