JULY 2023

ENGINEERING METROLOGY

Time Allowed: 2.5 Hours *Full Marks: 60*

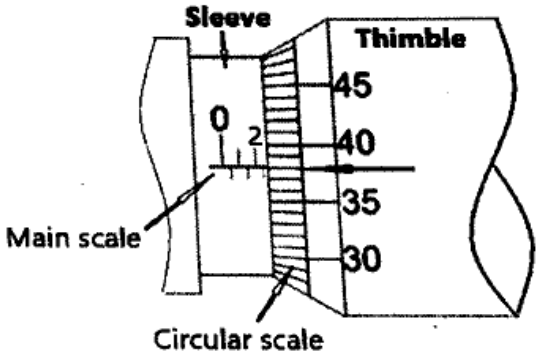
Answer to Question No. 1 which is compulsory and Answer any Five (05) Questions from the rest.

1. Answer from the given **(any five)**: **(3 x 5)**

a) Draw vernier caliper with proper labeling.
b) What do you understand by 'line standard' and 'end standard'?
c) Explain Backlash errors occurred in gear.
d) State "Taylor Principle" of gauge design.
e) Explain the terms: Tolerance, allowance, limits, basic size
f) What do you mean by surface texture? Which factors do affect the surface roughness?
g) What is primary texture? What are the causes of it?
h) What do you mean by the terms 'lay' and 'sampling length'?
i) Explain the terms local interchangeability and universal interchangeability.

2. i) Draw a simplified schematic diagram of shaft-hole assembly and show the followings – basic size, line of zero deviation, tolerance for hole, tolerance for shaft, and maximum allowance.
ii) What are the hole basis system shaft basis system? Explain with sketches. **5+4**

3. i) List important measuring instruments that are widely used in linear metrology.
ii) What do you understand by the term 'vernier constant' of a vernier caliper?
iii) Find out the total reading taken by a plain outside micrometer as shown in the following figure. Assume that the pitch of the screw is 0.5 mm and the circular scale on thimble has 50 equal divisions. **3+2+4**



4. A slip gauge set with 87 pieces, as under is available **(4.5 x 2)**

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

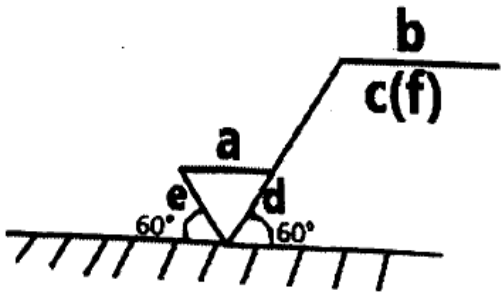
Build the following dimensions with minimum number of slip gauges i) 29.758 mm ii) 46.635 mm

5. i) With a neat sketch briefly describe the set up &working of a Sine Bar.
ii) A 100 mm sine bar is to be set up to an angle of 33^0 , determine the slip gauges needed from 87 pieces set. (4+5)

6. Determine the fundamental deviation and tolerances and the limits of size for hole and shaft pair in the fit: 25H8d9. The diameter steps are 18mm and 30mm. The fundamental deviation for "d shaft" is given as, -16D^0.44. The tolerance unit is, $i=0.45\sqrt[3]{D}+0.001D$. The tolerance grade for number 8 quantity (IT8) is 25i and for 9 (IT9) is 40i. (9)

7. i) With neat sketch show the following gear terminology of a spur gear: circular pitch, base circle, pitch circle, addendum circle, and tooth thickness.
ii) With a neat sketch explain the measurement of circular pitch of a spur gear. (5+4)

8. i) What are the various techniques used for qualitative analysis of surface roughness.
ii) Write short note on 'Centre Line Average' (C.L.A.) method of measuring average surface roughness.
iii) What does the drawing indicate as shown in following figure? (2+2+5)



9. i) What is comparator? Classify it.
ii) With the help of a neat sketch, explain the working principle of dial indicator in brief. (4+5)

10. i) With neat sketch show the following terminology of a screw thread: nominal diameter, core diameter, effective diameter, pitch, crest, root, and pitch line.
ii) What is thread gauge? Classify it.
iii) What are the various methods used to measure the effective diameter of screw thread? (4+2+3)

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