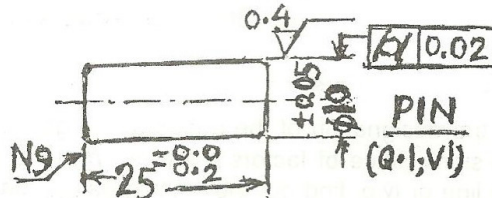


- N.B. :** (1) Question No. 1 is **compulsory**. Attempt any **four** of the remaining **six** questions. **Total five** questions are to be attempted.
 (2) **Every** new question should be started on **fresh** page of the answerbook.
 (3) **Figures** to the **right** indicate **full** marks for that question.
 (4) Assume **suitable** additional data if **required** and **justify** it.
 (5) Your answers should be in **brief** to the point, with supporting **free hand sketches** wherever **required**.

1. Answer any **seven** of the following in 2-3 lines each. Draw **figure** wherever required:— **20**

- Specify the right measuring instrument/device (range; L.C./Resolution and Instrument accuracy) to measure (i) Cylindrical pin length "L" = 32 ± 0.15 within 0.05 accuracy. (ii) $\phi 20 \pm 0.1$ hole; gauging on a sample for the purpose of lot acceptance.
- State two applications/conditions under which an Electric Comparator can NOT be used. Justify your answer in 1-2 lines each.
- In a flatness check of a slip gauge surface by interferometry, ten fringe pitches are observed under a monochromatic light of wavelength = 0.47μ . Estimate the flatness error in " μ ". If the fringes observed are curved, what does it mean? State in 1-2 lines only.
- State one similarity and two dissimilarities between a thermometer and a pyrometer.
- Calculate the best wire diameter for M20 \times 2.5 ISO screw thread. For what purpose this wire is used? Answer in one sentence.
- Classify the various tolerances shown in the following part drawing "PIN", as Linear, Geometry / form and surface finish tolerance. Explain in a line or two the meaning of any one surface finish tolerance from it.



- Derive the 'Go and No Go' sizes, the conventional gauge tolerance and wear allowance in respective limit gauges for shaft $\phi 50^{+0.0}_{-0.2}$ mm. Justify your answers by basic principle.
- Name the two most primitive length standards used in measurements. State two reasons why these standards were replaced by optical/length standards.
- Is a precision measurement always accurate? Justify in 2-3 lines with a simple example.

- Draw a neat free hand working sketch of SIGMA mechanical comparator highlighting its five special features; in point form. State two limitation of it. **10**
 - With neat free and sketches, define in a line or two, any **five** of the followings:— **10**
 - Pressure angle of involute spur gear
 - Full depth of the gear tooth.
 - Root diameter of a screw thread
 - Base circle diameter of involute gear
 - Condition for complete interference of light waves
 - H₇M₆ ISO fit
 - Effective diameter and lead of screw the thread.

3. (a) State the working principle of LVDT with a neat labelled free hand sketch, indicating major elements of it. State in brief, two practical uses of LVDT in mechanical Measurement. Indicate one similarity and one major difference between LVDT and Piezo electric transducer. **10**
- (b) During P.C.D. measurement of an involute spur gear (with module = 4 mm; pressure angle = 18 ° and No. of teeth = 22), following measurements in mm. are obtained over a pair of standard gauge rollers : 93.971; 93.968; 93.981; 93.981; 93.970. Calculate- (i) The suitable gauge roller diameter used in this measurement (ii) The average measured P.C.D. Derive the necessary equations for the above measurement i.e. Equations for the required gauge roller diameter and P.C.D. in terms of measurement over rollers. (iii) Draw a neat labelled free hand diagram to show this measurement set up. **10**
4. State your view in 4 to 5 points **each** on any **three** of the followings with sketches :- **20**
- (a) Flush pin gauge construction and its application
- (b) Gauging for flatness error with NPL flatness Interferometer ; upto 25 mm. Slip gauge and larger then 25 mm. Slip gauge both.
- (c) Comparison of screw thread effective ϕ measurement by Bench micrometer and hand held micrometer.
- (d) Tooth to tooth and cumulative gear pitch error measurement.
5. (a) Design a set of limit gauges to check the shaft and hole of an assembly; by indicating the component and gauge tolerance dispersion by IS practice, based on the following data - **12**
- (i) Shaft $\phi = \frac{34.950}{34.925}$ mm; mating with $\phi 35$ H₇ hole so as to have maximum assembly clearance = 100 μ ... (Show the calculations for hole limits based on this)
- (ii) Z = 3.5 = Z₁ ; H = 4 = H₁ ; Y = 3 = Y₁ (All in usual units)
- (b) (i) Write down the designation of the above set of gauges by IS practice. **3**
- (ii) What is the significance of factors y and y₁ in the above gauge design ? **5**
Explain in a line or two, find out the limiting gauge diameters permitted by your design for the actual use of gauges based on these factors.
6. (a) State in the point form with a neat free hand labelled sketch, the basic principle of working of back pressure pneumatic gauge. Derive the following for this gauge, explaining briefly meaning of 1% linearity. **10**
 $L_{\text{maximum}} - L_{\text{minimum}} = L_{\text{average}}$; all with usual notations.
- (b) Comment with 3-4 points ; with supporting labelled free hand sketches ; on - **10**
- (i) Multi gauging industrial system (any **one** application)
- (ii) Versatile applications of air gauging in mechanical measurements (any **three** applications).
7. Answer the followings in brief with supporting sketches as required :- **20**
- (a) Define monochromatic light. State any three types/sources of monochromatic light used in interferometry listing one advantage and one limitation of each type.
- (b) What do you understand by calibration of measuring instruments ? Answer in 2-3 lines. State three major reasons to calibrate instruments.
- (c) Clarify with 3-4 points the overall magnification of Taylor-Hubson surface texture meter.
- (d) Highlight with 3-4 points the worth of 3D-CMM in industrial meterology. (with at least one example).