



# MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : PC-ME404 Metrology and Instrumentation

Time Allotted : 3 Hours

Full Marks :70

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

## Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :

[ 1 x 10 = 10 ]

- (i) The relationship that results between the two mating parts before assembly is called \_\_\_\_\_
- (ii) What is the thread angle of an Acme Thread?
- (iii) What is Hysteresis?
- (iv) Why pyrometer is used?
- (v) What Is the purpose of using a Sine Bar?
- (vi) What is the difference between the maximum and minimum permissible limits of the sizes called ?
- (vii) A thread designation is given as SQ 20 x 5, what does that indicate?
- (viii) What do you mean by drift?
- (ix) What is a strain gauge?
- (x) What is a parallax error?
- (xi) What is an optical flat used for?
- (xii) Which screw thread profile is the combination of square and V- threads?

## Group-B (Short Answer Type Question)

Answer any three of the following

[ 5 x 3 = 15 ]

2. Distinguish between 'line standards' and 'end standards'. How are the end standards derived from line standards? [ 5 ]
3. Calculate the effective diameter in the following cases: [ 5 ]
  - (i) Micrometer reading over standard cylinder with two wires of diameter = 15.64 mm
  - (ii) Micrometer reading over the gauge with two wires as 15.26 mm and pitch of thread = 2.5 mm
  - (iii) Wire of 2-mm diameter and standard cylinder = 18 mm
4. What are the dynamic characteristics of a Measurement System? [ 5 ]
5. Describe briefly the construction and working of Strain gauge load cell. [ 5 ]
6. Explain how an auto-collimator can be used for straightness measurement. [ 5 ]

## Group-C (Long Answer Type Question)

Answer any three of the following

[ 15 x 3 = 45 ]

7. (a) Discuss the principles and applications of metrology and instrumentation. [ 7 ]
   
(b) Explain the classification of measuring instruments. [ 8 ]
8. (a) A hole and mating shaft are to have a nominal assembly size of 40 mm. The assembly is to have maximum clearance of 0.15 mm and minimum clearance of 0.05 mm and hole tolerance is 1.5 times the shaft tolerance. Determine the limits for both hole and shaft by using hole basis system and shaft basis system. [ 8 ]
   
(b) Describe the working of NPL Flatness Interferometer. [ 7 ]
9. (a) Explain the nomenclatures of screw thread with the help of a neat sketch. [ 7 ]
   
(b) Describe V and Square type thread with their advantages and limitation. [ 8 ]
10. (a) Describe the working principle of LVDT. [ 7 ]

- (b) The output of a LVDT is connected to a 4 V voltmeter through an amplifier whose amplification factor is 500. An output of 1.8mV appears across the terminals of LVDT when the core moves through a distance of 0.6mm. If the milli-voltmeter scale has 100 divisions and the scale can be read to 1/4 of a division, calculate: I) the sensitivity of LVDT II) The resolution of the instrument in mm. [ 8 ]
11. (a) A load cell consists of a solid cylinder of steel 60 mm in diameter with four strain gauges bonded to it and connected into the four arms of a voltage sensitive bridge. If the gauges are each of  $120\Omega$  resistance and the gauge factor of 2, the bridge excitation voltage 6 V, Determine the sensitivity of the cell in  $\mu\text{V} / \text{kN}$ . Modulus of elasticity for steel is  $200\text{GN/m}^2$  and the Poisson's ratio is 0.3. [ 10 ]
- (b) What are the advantages and disadvantages of resistance thermometers? [ 5 ]

\*\*\* END OF PAPER \*\*\*