

**METROLOGY & MEASUREMENT  
(MECH 2105)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and  
any 5 (five) from Group B to E, taking at least one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group – A  
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Main scale reading of a micrometer is 12 mm and reading on the thimble is 36. The pitch of the spindle screw is 0.50 mm and number of divisions on the thimble is 50. The actual measurement is  
(a) 12.36 mm (b) 11.64 mm  
(c) 12.72 mm (d) 11.28 mm.
- (ii) Least count of a vernier bevel protractor is  
(a) 5 degrees (b) 5 seconds  
(c) 5 radians (d) 5 minutes.
- (iii) The two slip gauges in precision measurement are joined by  
(a) Assembling (b) Sliding  
(c) Adhesion (d) Wringing.
- (iv) Least count of a Vernier caliper is  
(a) Smallest division on vernier scale/ Total no. of divisions in main scale  
(b) Smallest division on main scale/ Total no. of divisions in vernier scale  
(c) Smallest division on vernier scale/ smallest division on main scale  
(d) None of (a), (b) and (c).
- (v) Bourdon Gauge is used for measurement of  
(a) Temperature (b) Displacement  
(c) Parallelism (d) Pressure.
- (vi) In engineering drawing, surface roughness of a component is represented by  
(a) Circles (b) Triangles  
(c) Squares (d) Rectangles.

- (vii) Most accurate measurement of flatness can be done using  
(a) Spirit level (b) Dial Gauge  
(c) Optical Flat (d) None of (a), (b) and (c).
- (viii) Dial Gauge is a  
(a) Mechanical Comparator (b) Depth Measuring Device  
(c) Pneumatic Comparator (d) None of (a), (b) and (c).
- (ix) Calibration of an instrument is done to  
(a) Enhance its sensitivity  
(b) Improve response time of the instrument  
(c) Establish relationship between displayed value with actual input value  
(d) None of the above.
- (x) "Roughness" is  
(a) Primary texture (b) Secondary texture  
(c) Flaw (d) Tertiary texture.

**Group – B**

2. (a) Define Metrology. Name the SI unit of measurement for mass, time and length.  
(b) Explain absolute error and calibration error.  
**(3 + 3) + (3 + 3) = 12**
3. (a) How to use vernier calliper to measure the length of an object using main scale and vernier scale reading.  
(b) A 100 mm sine bar is used to measure angle of a component. Slip gauges having total height of 24 mm is put under the sine bar roller to make the top surface of the component horizontal. Calculate the angle of the component in degree.  
**6 + 6 = 12**

**Group – C**

4. (a) What is the application of a comparator ? Name three types of comparator.  
(b) Explain the working principle of dial gauge with neat sketch.  
**(3 + 3) + 6 = 12**
5. (a) What is upper and lower limit of a product? What is the importance of tolerance in an object?  
(b) How to measure thread profile using a profile projector?  
**(3 + 3) + 6 = 12**

**Group – D**

6. (a) Define (i) Accuracy (ii) Precision (iii) Sensitivity of an instrument.  
(b) Explain the difference between active and passive transducer with examples.

$$(2 + 2 + 2) + 6 = 12$$

7. (a) Distinguish roughness, waviness and Lay of a surface with their characteristics.  
(b) In measurement of surface roughness, absolute values of height and depth of 5 successive peaks and valleys measured from a datum are as follows:  
Peaks : 40, 48, 53, 60, 62 micron  
Valleys : 25, 18, 32, 16, 20 micron  
Determine the  $R_z$  value of the surface.

$$(2 + 2 + 2) + 6 = 12$$

**Group – E**

8. (a) Explain the working principle of LVDT with proper sketch.  
(b) How to measure force by strain gauge load cell.

$$6 + 6 = 12$$

9. (a) Explain the method to use a "Bourdon tube gauge" with proper diagram.  
(b) Explain the construction and use of thermocouple with proper sketch.

$$6 + 6 = 12$$