

**MECHANICAL MEASUREMENT AND INSTRUMENTATION  
(MECH 2211)**

**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) Which of the following is preferred for selecting a combination of slip gauges?  
(a) Writing out and selecting the closest one          (b) Averaging  
(c) Determining the fewest number of blocks          (d) All of these.
- (ii) How many divisions are there in the “Thimble” of outside micrometer?  
(a) 50    (b) 60  
(c) 40    (d) 70.
- (iii) A 100mm sine bar is used to measure angle of a component. Slip gauges having total height of 25 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  
(a) 13.25    (b) 14.48  
(c) 12.27    (d) 9.67
- (iv) Main scale reading of a micrometer is 11 mm and reading on the thimble is 34. The pitch of the spindle screw is 0.50 mm. The actual measurement is  
(a) 11.34 mm    (b) 11.50 mm  
(c) 11.68 mm    (d) 11.17 mm
- (v) “Waviness” is  
(a) Primary texture    (b) Secondary texture  
(c) Flaws    (d) Tertiary texture
- (vi) Dial indicator is a  
(a) transducer    (b) comparator  
(c) actuator    (d) instrument
- (vii) The system in which the dimension of the shaft is kept constant and the hole size is varied to obtain various types of fits is referred to as  
(a) hole basis system    (b) shaft basis system  
(c) fit basis system    (d) tolerance basis system

- (viii) Piezoelectric crystal is an example of  
(a) passive transducer (b) active transducer  
(c) active transformer (d) passive transformer
- (ix) Optical pyrometer is used for the measurement of  
(a) temperature (b) pressure  
(c) displacement (d) light
- (x) Angle of a hacksaw blade teeth can be measured by  
(a) Vernier bevel protractor (b) Vernier calliper  
(c) Outside micrometer (d) Profile Projector.

**Group - B**

2. (a) Distinguish between direct and indirect way of measurement. *[[CO1](Analyze/IOCQ)]*  
(b) Explain the method to measure parallelism and cylindricity of surfaces by using dial indicator. *[[CO1](Apply/IOCQ)]*  
**6 + 6 = 12**
3. (a) How to find out the least count of a vernier calliper. *[[CO3](Apply/IOCQ)]*  
(b) Demonstrate the structure, characteristics and application of a sine bar with slip gauge. *[[CO3](Understand/LOCQ)]*  
**6 + 6 = 12**

**Group - C**

4. (a) The following limits are specified for a hole shaft assembly.  
Hole =  $30^{+0.08}_{-0.00}$  Shaft =  $30^{-0.006}_{-0.030}$   
Determine the followings:  
i) Basic size, Tolerance of shaft and hole.  
ii) Maximum and minimum clearance, allowance. *[[CO2] (Analyze/IOCQ)]*  
(b) Differentiate between hole basis system and shaft basis system. *[[CO2] (Apply/IOCQ)]*  
**6 + 6 = 12**
5. (a) Justify the applications and required characteristics of a comparator in industry. *[[CO3](Evaluate/HOCQ)]*  
(b) Describe the method to measure teeth profile of a hacksaw blade using profile projector. *[[CO1](Apply/IOCQ)]*  
**6 + 6 = 12**

**Group - D**

6. (a) Define transducer. Classify transducer based on power requirement. *[[CO4] (Understand/LOCQ)]*

(b) Explain the functional elements of a measuring instrument with proper diagram.

[[CO4](Understand/LOCQ)]

**(2 + 4) + 6 = 12**

7. (a) Define flaws, roughness and sampling length of a surface with neat sketch.

[[CO5] (Remember/LOCQ)]

(b) Describe any one method of numerical evaluation of surface roughness.

[[CO5] (Evaluate/HOCQ)]

**6 + 6 = 12**

### **Group - E**

8. (a) What is strain? How to measure it with the help of a strain gauge?

[[CO6] (Apply/IOCQ)]

(b) Explain the working principle of “bourdon tube gauge” with neat sketch.

[[CO6] (Understand/LOCQ)]

**(2 + 4) + 6 = 12**

9. (a) Justify the application of thermocouple based on its working principle.

[[CO6] (Evaluate/HOCQ)]

(b) Explain the construction and characteristics curve of a LVDT.

[[CO6] (Understand/LOCQ)]

**6 + 6 = 12**

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<i>Cognition Level</i>	<i>LOCQ</i>	<i>IOCQ</i>	<i>HOCQ</i>
<i>Percentage distribution</i>	<i>37.5</i>	<i>43.75</i>	<i>18.75</i>

### **Course Outcome (CO):**

At the end of the course, a student will be able to

1. Classify various measuring techniques.
2. Implement the concept of interchangeability, fits and tolerance in engineering drawings and manufacturing.
3. Demonstrate the structure and characteristics of measuring instruments.
4. Define and understand the working principle of transducers.
5. Apply the knowledge of surface finish and its measurement for design of engineering components.
6. Select and operate measuring instruments such as LVDT, SEM, Strain Gauge, Piezoelectric load cell, Pneumatic gauge, Thermocouple, Optical Pyrometer as necessitated by the engineering application.

\*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.

