

**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) Thread angle of a screw can be best measured by
 - (a) Sine bar
 - (b) Profile projector
 - (c) Vernier Bevel Protractor
 - (d) Pneumatic Gauge.
 - (ii) If the Fit between a shaft and hole is designated as H7/g6, assembly will have
 - (a) interference fit
 - (b) transition fit
 - (c) clearance fit
 - (d) cannot be ascertained.
 - (iii) Main scale reading of a micrometer is 10 mm and reading on the thimble is 27. The pitch of the spindle screw is 0.50 mm and number of divisions on the thimble is 50. The actual measurement is
 - (a) 12.70 mm
 - (b) 10.27 mm
 - (c) 10.027 mm
 - (d) 10.0027 mm.
 - (iv) Lower limit of diameter of a shaft can be quickly checked by suitable
 - (a) 'GO' snap gauge
 - (b) Dial gauge
 - (c) 'NO GO' snap gauge
 - (d) 'GO' plug gauge.
 - (v) LVDT is usually used for measuring
 - (a) load
 - (b) pressure
 - (c) strain
 - (d) displacement.
 - (vi) Symbol "inverted triangle" is used in engineering drawings for representing.
 - (a) Shape of a component
 - (b) Surface Flatness
 - (c) Hardness
 - (d) Surface roughness.
 - (vii) Roughness is
 - (a) primary texture
 - (b) secondary texture
 - (c) tertiary texture
 - (d) lay.
 - (viii) In vernier calliper 50th division of vernier scale match with which division of main scale.
 - (a) 51
 - (b) 49
 - (c) 50
 - (d) 100.

- (ix) Bourdon gauge is used for the measurement of
(a) temperature (b) pressure (c) displacement (d) parallelism.
- (x) Which of the following is not a type of fit?
(a) Clearance (b) Interference (c) Transition (d) Loose.

Group- B

2. (a) Define with suitable sketches [[CO1](Remember/LOCQ)]
 (i) Flatness of a surface
 (ii) Roundness
 (iii) Cylindricity.
- (b) Compute the slip gauge block combinations to build the following dimensions:
 (i) 15.09
 (ii) 112.475

The slip gauge set M 38 consists of the following: [[CO1](Analyse/IOCQ)]

Range (mm)	Steps (mm)	Pieces
1.005		01
1.01-1.09	0.01	09
1.1-1.9	0.1	09
1.0-9.0	1.0	09
10.0-100.0	10.0	10

6 + 6 = 12

3. (a) Explain the steps of measuring angle with vernier bevel protractor. [[CO3](Apply/IOCQ)]
- (b) Demonstrate the structure, characteristics and application of a outside micrometer. [[CO3](Understand/LOCQ)]

6 + 6 = 12

Group – C

4. (a) Differentiate between
 (i) Clearance and interference fit
 (ii) Maximum and minimum material limit. [[CO2](Analyze/IOCQ)]
- (b) The following limits are specified for a hole shaft assembly.

$$\begin{array}{l} \text{Hole} = \begin{array}{c} 70^{+0.07} \\ -0.00 \end{array} \quad \text{Shaft} = \begin{array}{c} 70^{-0.008} \\ -0.040 \end{array} \end{array}$$

Determine the followings:

- (i) Basic size, Tolerance of shaft and hole.
 (ii) Maximum and minimum clearance, allowance. [[CO2](Apply/IOCQ)]

6 + 6 = 12

5. (a) Briefly explain with sketch how a Profile Projector works. How can it be used for measuring pitch of a screw? [[CO3](Remember/LOCQ)]

- (b) Explain with a sketch the working principle of a Back Pressure Bourdon Gauge comparator and how can it be used for measuring bore diameter of a ring type component? [(CO3)(Analyze/IOCQ)]

6 + 6 = 12**Group – D**

6. (a) Explain the difference between Accuracy & Precision of an instrument. [(CO4)(Analyze/IOCQ)]
 (b) Explain the difference between Sensitivity & Threshold of an instrument. [(CO4)(Analyze/IOCQ)]
 (c) Explain the functional elements of a measuring instrument with proper diagram. [(CO4)(Understand/LOCQ)]

3 + 3 + 6 = 12

7. (a) Using a suitable diagram/ graph with proper notations, write the expression for calculation of CLA roughness value of a surface. [(CO3)(Remember/LOCQ)]
 (b) In the measurement of surface roughness, absolute value of height/ depth of 10 successive peaks and valleys measured from a datum as follows:
 Peaks: 45, 42, 40, 35, 35 μm
 Valleys: 30, 25, 25, 24, 18 μm
 If the sampling length is 5 mm, determine the R_z and RMS value of the surface roughness. [(CO6)(Evaluate/HOCQ)]

4 + (4 + 4) = 12**Group - E**

8. (a) What is gauge factor? Explain the working principle of a strain gauge load cell with neat sketch. [(CO6)(Apply/IOCQ)]
 (b) Differentiate between thermometer and thermocouple based on their working principle and application. [(CO6)(Analyze/IOCQ)]
9. (a) Describe the laws of thermocouple. How the Seebeck voltage can be used for measuring temperature? [(CO6)(Evaluate/HOCQ)]
 (b) Draw the basic circuit diagram and cross-sectional view of a Linear Variable Differential Transformer and explain how it functions. [(CO5)(Remember/LOCQ)]

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	35.42	50	14.58

Course Outcome (CO):

On completion of the course, a student will be able to

C01: Classify various measuring techniques.

C02: Implement the concept of interchangeability, fits and tolerance in engineering drawings and manufacturing.

C03: Demonstrate the structure and characteristics of measuring instruments.

C04: Define and understand the working principle of transducers.

C05: Apply the knowledge of surface finish and its measurement for design of engineering components.

C06: 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