

Time: 3 Hours

Total Marks: 80

- N.B:** 1) Question No. 1 is compulsory.  
2) Attempt any THREE questions out of remaining FIVE questions.  
3) Assume suitable data wherever necessary.  
4) Use of Graph paper is allowed.  
5) Figures to the right indicate full marks.

1. Answer of the following questions (any Four). (20)
- i) Differentiate between primary, secondary and tertiary standards.
  - ii) Explain roughness and waviness with suitable diagram.
  - iii) Define: Accuracy, Precision, Span and Range of measuring instruments.
  - iv) What is RTD? How does it work?
  - v) Define the term transfer function with its significance in control system.
  - vi) Write a note on *Frequency domain specifications*.
2. (A) Define the term gauge factor of a strain gauge with its significance. (05)
- (B) Describe with neat diagrams the working of *McLeod gauge* for the pressure measurement. (05)
- (C) Find the shaft and hole dimensions with tolerance for a **90 H8 e9 pair** with the following data: (10)
- 90 mm** lies in the diameter step of **80 to 100 mm**  
Upper deviation for e shaft =  $11 D^{0.41}$   
Tolerance unit  $i = 0.45 D^{1/3} + 0.001D$  micron
- Also find the type of fit produced.
3. (A) Classify control system with suitable examples. (05)
- (B) What is difference between unilateral and bilateral tolerances? Why is unilateral tolerance preferred over bilateral tolerance? (05)
- (C) Describe with neat diagrams the working principle of the magnetic flow meter and ultrasonic flow meter for flow measurement. (10)

4. (A) What is the difference between direct and indirect measuring instrument? Give one (05)  
example of each type.

(B) A system is represented by the characteristic equation (05)

$$P(S) = S^6 + S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0,$$

Determine the stability of the system by using Routh's criterion.

(C) Define *Interferometry*. Describe with neat sketch the working principle of Laser (10)  
interferometer.

5. (A) Describe with neat sketch '*Two Wire Method*' in screw thread measurement. (10)

(B) Define desired input, modifying input and interfering input for measuring instruments (10)  
with suitable examples. Also suggest the methods to minimize the effect of modifying  
and interfering input.

6. (A) A unity feedback system is characterized by open loop transfer function (10)

$$G(s) = \frac{25}{s(s+5)}$$

For a unit step input, determine a) Rise time, b) Peak time, c) Settling time d) Peak  
overshoot.

(B) A system is characterized by transfer function (10)

$$G(s) H(s) = \frac{K}{s(s+5)(s+10)}$$

Determine the stability of the system by using root locus method.