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 the following questions (*any Four*). **20**

i) What is Metrology? Explain different types of standards.

ii) With respect to surface roughness parameters explain the following terms:
i) Ra; ii) Ry; iii) Rz

iii) Define:
i) Sensitivity
ii) Precision
iii) Threshold

iv) Explain the working of LVDT with a neat sketch.

v) Distinguish between open loop and closed loop control systems.

vi) Using Routh's criterion examine the stability of a control system whose characteristic equation is $\mathbf{4S^5 + 2S^4 + 4S^3 + 8S^2 + 2S + 10 = 0}$

2. (A) Explain with a neat sketch the N.P. L. flatness interferometer. **10**

(B) Design a general type of Go and No Go plug gauge for inspecting a hole 25 D8. Given that: **10**

$\mathbf{i = 0.40\sqrt[3]{D} + 0.001D}$ micron

Tolerance for hole = **25 i**

Fundamental deviation of the hole= $\mathbf{16\ D^{0.44}}$

Wear allowance 10% of gauge design

3. (A) Explain the term clearance fit with respect to limit fit diagram **05**

(B) Derive necessary expression to calculate the best wire diameter. **05**

(C) Draw the Root-Locus of the system having **10**

$$G(s)H(s) = \frac{K}{S(S+1)(S+4)}$$

4. (A) Define gauge factor of strain gauges. Derive an expression for gauge factor. **05**

(B) Briefly, discuss drift. **05**

(C) A system has transfer function given by **10**

$$G(s)H(s) = \frac{100\,(s+2)}{s(s+1)(s+4)}$$

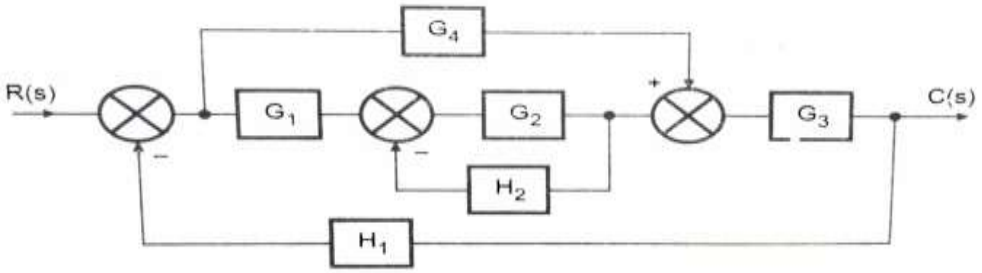
Determine:

i) Type of system
ii) Error constants K_p, K_v and K_a
iii) Steady state error for input magnitude 2

10

5. (A) Explain generalized measurement system elements with block diagram. Describe its function with suitable examples. **10**

(B) Reduce the given block diagram to a its canonical form and hence obtain equivalent transfer function, $\frac{C(s)}{R(s)}$. **10**



6. Write short note on ***(any Four)*** **20**

i) Mc-Leod Gauge
ii) RTD
iii) Magnetic Flow Meter
iv) Frequency Domain Specifications
v) Parkinson's Gear Tester
vi) Range and Span
