**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) Define wavelength standard and state the significance of using it.

   ii) Explain different types of fits with suitable examples and sketches

   iii) Differentiate between roughness and waviness.

   iv) Define and explain i) Resolution; ii) Threshold; iii) Hysteresis

   v) Briefly explain the construction and working of a strain gauge load cell.

   vi) Using Routh's criterion examine the stability of a control system whose characteristic equation is $S^5 + S^4 + 2S^3 + 2S^2 + 3S + 15 = 0$

2. **(A)** Define Interferometry. Explain Laser Interferometer with neat sketch.   **10**

   (B) Reduce the given block diagram to a it's canonical form and hence obtain equivalent transfer function, $\frac{C(s)}{R(s)}$.   **10**
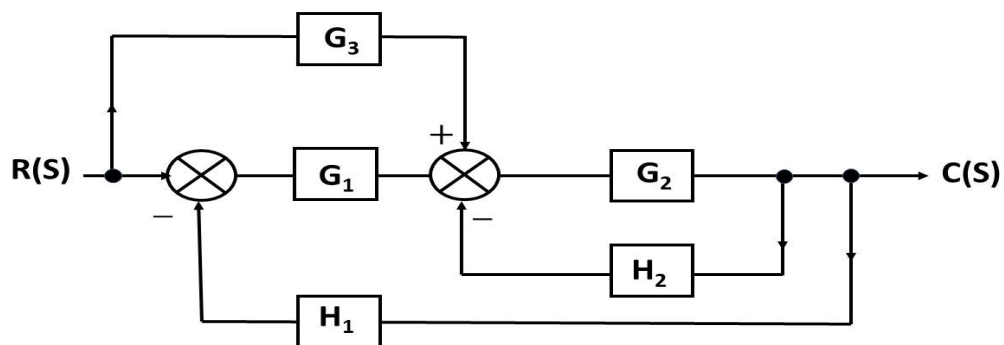
3. **(A)** Explain generalized measurement system elements with block diagram. Describe functions with suitable examples.   **10**

   (B) A unity feedback system has $G(s) = \dfrac{K}{S(2+S)(4+S)}$ **10**

   a. If $r_{(t)} = 2t$ and $K = 4$, find steady state error.
   b. If it is desired to have steady state error to be 0.4, find corresponding value of "K"
   c. Find steady state error if input is changed to 2+6t, and value of K to 10.

4. **(A)** Explain principle, construction and working of *Parkinson Gear Tester*   **10**

     (B) Draw the root locus and comment on the stability of the control system having open loop **10** transfer function as follows:

$$G(s)H(s) = \frac{K}{s^2(s+1)}$$

5. **(A)** What are encoders? With a neat sketch, explain the working of an incremental and **10** absolute optical encoder. Give examples of their use.

     (B) Design a general type of Go and No Go plug gauge for inspecting a hole 25 d8. Given **10** that:

         i = 0.40 D$^{1/3}$ + 0.001D micron

         Tolerance for hole = **25 i**

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

         Wear allowance 10% of gauge design

6. Write short note on *(any Four)*   **20**
  - i)   Floating Carriage Micrometer
  - ii)   Repeatability and Reproducibility
  - iii)   Ultrasonic Flow Meter
  - iv)   Capacitive Pressure Transducer
  - v)   Types of Measurement System Inputs
  - vi)   Frequency Domain specifications

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