Con. 7076-13. **LJ-11431**

(3 Hours) **[Total Marks : 100**

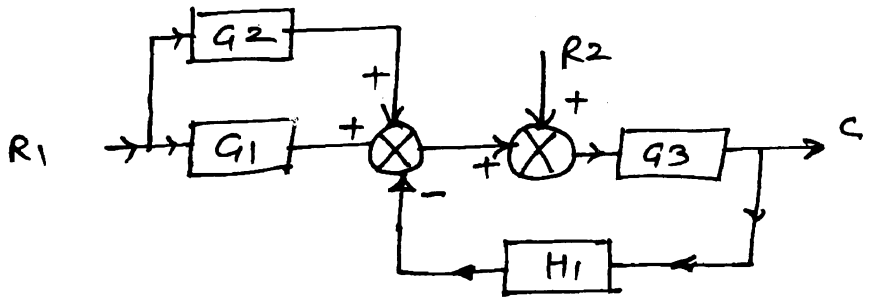
N.B. : (1) Question no. **1** is **compulsory**.
(2) Answer any **four** out of remaining **six** questions.
(3) **Figures** to the **right indicate** full marks.
(4) Illustrate answers with sketches and graph, wherever required.
(5) Assume **suitable** data if necessary.

1. Answer the following :– **20**
   (a) Define sensitivity of a control system. How can we reduce the sensitivity of a closed loop system.
   (b) Explain Hurtvitz stability criterion with its disadvantages.
   (c) Define following terms related to second order system, subjected to a unit step input.
      (i) Rise time.
      (ii) Peak time.
      (iii) Peak overshoot.
      (iv) Delay time.
      (v) Setting time.
   (d) What are the advantages of a Nyguist Plot.

2. (a) If a second order control system has transfer function $F(s) = S^2+24S+9$. **10**
   If a step input is applied to it, determine the time domain specifications. Also sketch the time response.
   (b) Find the range ot 'k' to make the system stable for a unity feedback system. **10**

$$G(S) = \frac{K(S+20)}{(S+2)(S+3)}$$

3. (a) Determine the transfer functions $\frac{C}{R1}$ and $\frac{C}{R2}$ from the given system below :– **10**
   Also find C/R.



   (b) Find the transfer function of the following system by using signal flow graph. **10**

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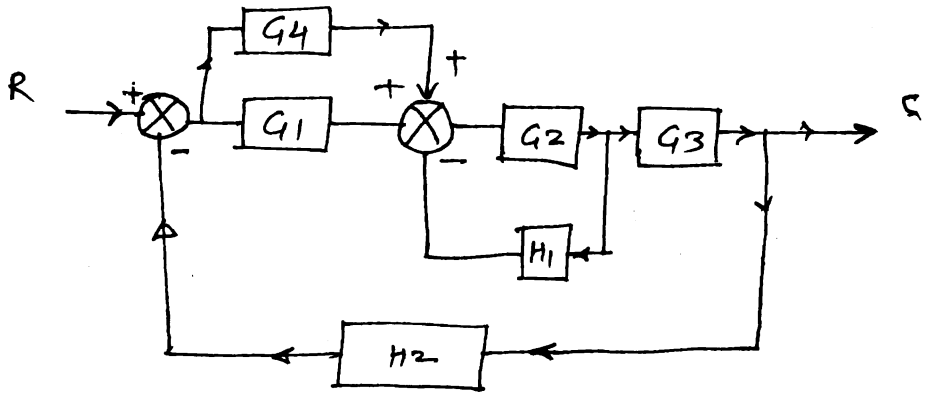

4. (a) Draw the complete root locus for the system :– $G(S)\,H(S) = \dfrac{K}{S(S+3)(S+6)}$ **10**

Obtain the value of k when $\xi = 0.6$ from root locus. Also determine the value of k for marginal stability and critical damping.

(b) For a unity feedback system :– $G(S) = \dfrac{200}{S(S+8)}$, and $r(t) = 2t$, Determine steady state error. If it is desired to reduce the existing error by 5%, find new value of gain of the system. **10**

5. (a) A unity feedback system has a loop gain $G(S)\,H(S) = \dfrac{60}{(S+4)(S^2+2S+5)}$ **10**

Determine the system stability using Nyguist plot.

(b) Compare open loop control system and closed loop control system with at least 3 examples. **10**

6. (a) Use Bode plot to determine the frequency response of system, H(S) = 1 **10**

$$G(S) = \frac{80S^2}{(2S+1)\,(S+1)(0.2S+1)}$$

(b) A unity feedback control system has $G(S) = \dfrac{K}{(S+4)^3}$ Determine the range of value of k for system stability. **10**

7. Write short notes on any **two :–** **20**
   (a) Stepper motor constructions and its applications in control system.
   (b) State variable model with an example.
   (c) Error compensation techniques.
