SE(IV) / Inst. / 19-05-14

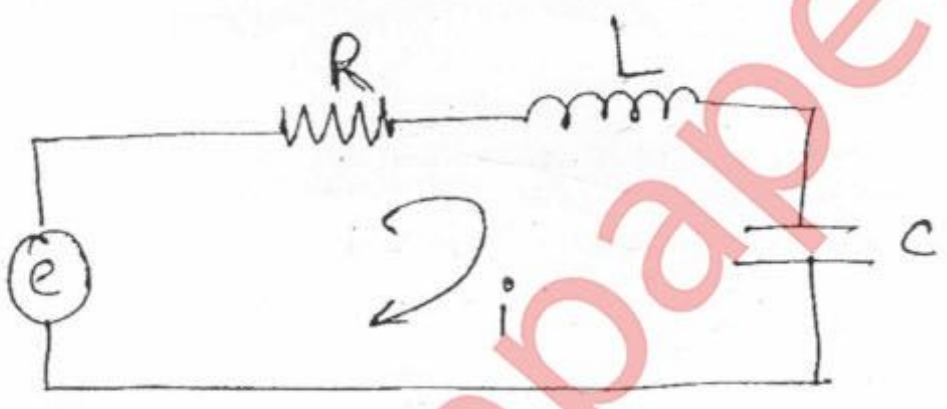
Feedback Control System.

QP Code : NP-19685

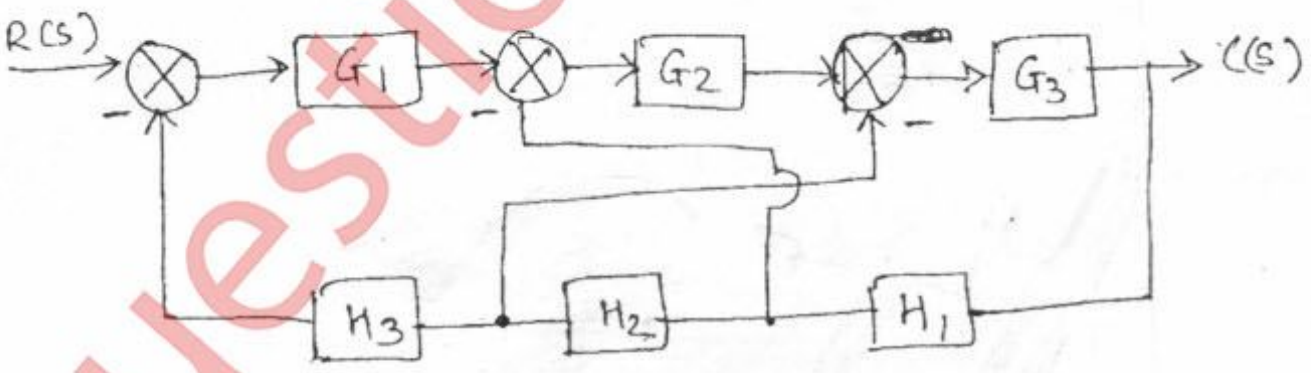
(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Solve any **three** from questions from remaining questions.
(3) Assume **suitable** data.

1. Attempt any **four** :– 20
   (a) Compare : open loop and close loop system with examples.
   (b) Define gain and phase margin of system also comment on stability of system based on the gain and phase margin.
   (c) Explain Force voltage and force current analogy.
   (d) Explain stable, unstable, critically stable and relatively stable system.
   (e) Find out transfer function of given network.



2. (a) Using block diagram reduction technique find the close loop transfer of the system, 10



(b) Test the stability for following :– 10
   (i) $S^5 + S^4 + 2S^3 + 2S^2 + 3S + 15 = 0$.
   (ii) $S^8 + 5S^6 + 2S^4 + 3S^2 + 1 = 0$.

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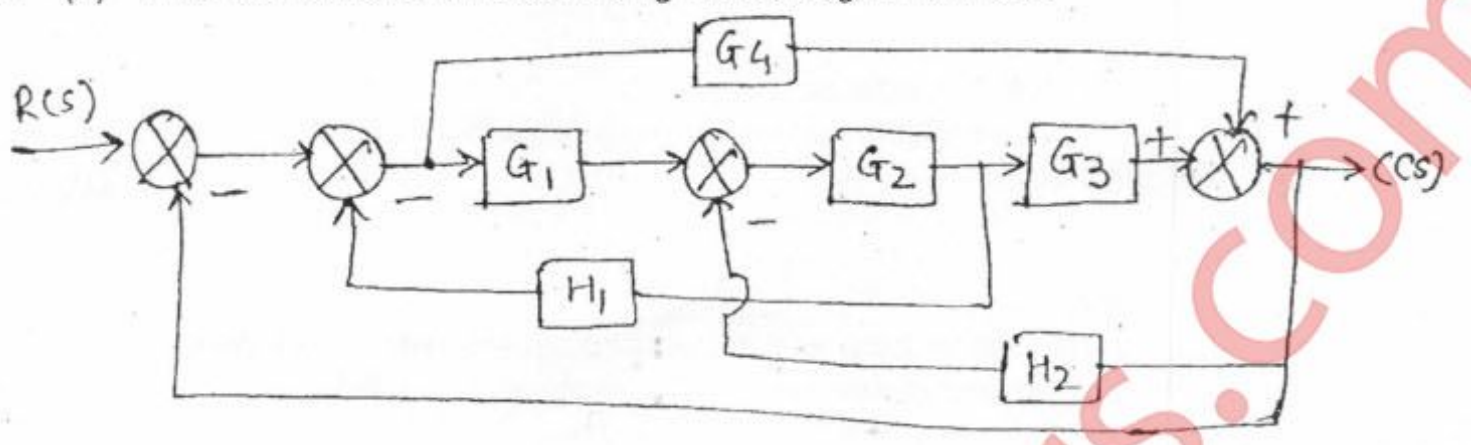
3. (a) Find the transfer function using mason's gain formula. 10



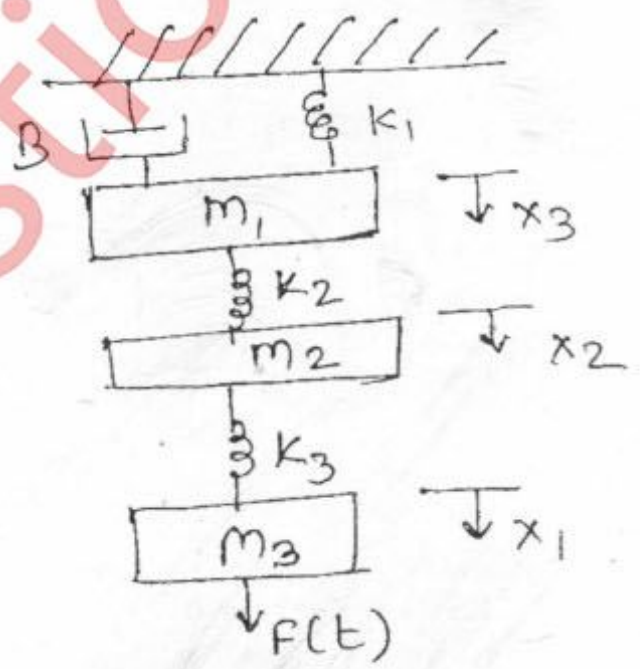
(b) For a system having $G(s) = \frac{15}{(s+1)(s+3)}$; $H(s) = 1$. 10

Determine :

(i) Characteristics equation
(ii) Wn and ξ
(iii) Time at which first undershoot will occur
(iv) Time period of oscillations
(v) No. of cycles output will per form, before settling down.

4. (a) Draw the root locus plot for a system with $G(s)\,H(s) = \frac{k}{s(s+2)(s+6)(s+10)}$. 10

(b) Draw the equivalent mechanical system of the given system. Write the set of equlibrium equation for it and obtain electrical analogy circuit using (i) F-V analogy (ii) F-I analogy. 10



5. (a) For a perticular unity feedback system $G(s) = \frac{242\,(s+5)}{s(s+1)\,(s^2+5s+121)}$ sketch the bode plot. Find W_{gc} and W_{pc}, GM, PM, commenton stability. 10

(b) For unity feedback system having openloop transfer function – 10

$$G(s) = \frac{14(s+3)}{s(s+5)\,(s^2+2s+2)}$$

Determine :–

(i) Type and order of the system

(ii) Error coefficient

(iii) Steady state-error for input $1+4t+\frac{t^2}{2}$.

6. (a) Sketch the polar plot and discuss the stability of the system reporesented 10

$$G(s)\cdot H(s) = \frac{k}{s(s+1)\,(s+5)}$$

(b) State and explain nyquist stblity theorem and its criteria. 10