01311

B.Tech. IN ELECTRICAL ENGINEERING

Term-End Examination

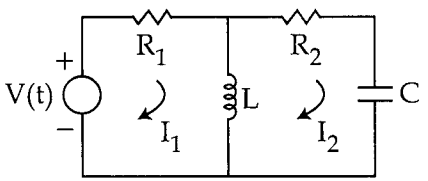
December, 2012

BIEE-021 : CONTROL SYSTEM

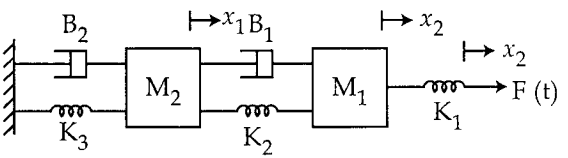
Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any five** question. Each question carry **equal** marks. Use graph.*

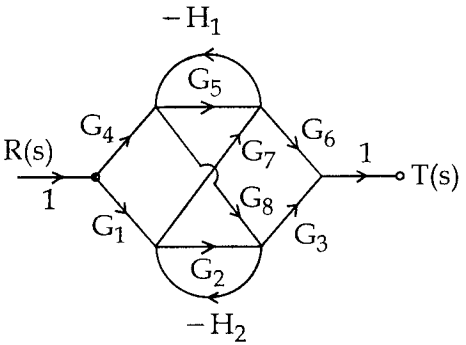
1. (a) For the given network find the transfer function $I_2(s)/V(s)$. **5**



(b) Obtain differential equations describing the mechanical system shown in figure and draw the electric network using force-voltage analogy. **9**



2. Define the mason's gain formula. Find the gain of the system shown in figure. **14**



3. (a) The control system having unity feedback has $G(s) = \frac{20}{S(1+4S)(1+S)}$. **10**

Determine

(i) Different error coefficient

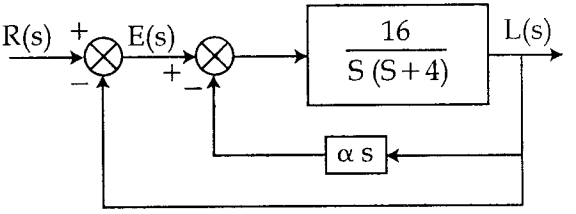
(ii) Steady state error if input is $r(t) = 2 + 4t + t^2/2$.

(b) Define the specifications of time domain response. **4**

4. The system shown in figure is a unity feedback control system with minor rate feedback crop. **14**

(a) In absence of rate feedback ($\alpha = 0$) determine overshoot of the system to unit step input and steady state error resulting from a unit ramp input.

(b) Determine the α which will decrease the peak overshoot of system, to unit step input, to 15%. What is e_{ss} to unit ramp input with this settling of the rate of feedback constant ?



5. (a) A unity feed back control system has 4

$$G(s) = \frac{K}{S\left(S^2+4S+5\right)(S+2)}.$$ Determine the range of K so that system is stable.

(b) The open loop transfer function of a unity feedback control system 10

$$G(s)H(s) = \frac{K}{S(S+2)(S+5)}$$ sketch the root locus of the system and determine the value of k for.

(i) Critical damping

(ii) Marginal Stability from the root locus.

6. (a) Sketch the Nyquist plot for $G(s) = \frac{1}{S^3}(S-1)$ also comment on stability. 10

(b) Explain the gain margin and phase margin. 4

7. Find Transfer function of : **14**

$$\begin{bmatrix} x^{\circ}_1 \\ x^{\circ}_2 \end{bmatrix} = \begin{bmatrix} -5 & -1 \\ 3 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 2 \\ 5 \end{bmatrix} r(t)$$

$$y = [1\ 2] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

8. Write short note on ***any two*** of the following : **2x7=14**

(a) DC and AC servomotor

(b) Different types of Controllers

(c) Routh - Hurwitz criterion