B. Tech Degree IV Semester Examination, April 2009

EE 404 LINEAR SYSTEM ANALYSIS

(2006 Scheme)

Time : 3 Hours Maximum Marks : 100

PART - A

(Answer ***ALL*** questions)

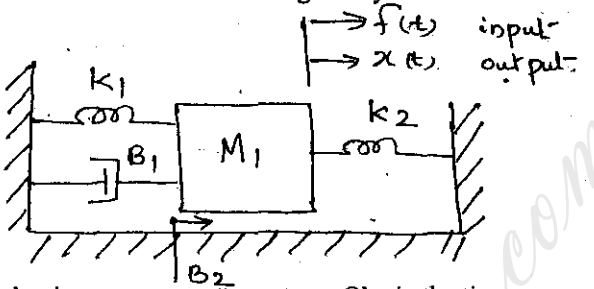
(8 x 5 = 40)

I. (a) Briefly explain the following with suitable examples :
(i) Time variant and time invariant systems (ii) Static and dynamic systems.

(b) Explain and illustrate mason's gain formula.

(c) Draw a simple thermal system and explain it with its associated variables and parameters.

(d) Obtain the transfer function of the given system.



(e) Define the time response of a system. Obtain the time response of a first order system to a unit ramp input.

(f) Briefly describe about the different static error constants.

(g) Decompose the transfer function $\frac{y(s)}{u(s)} = \frac{s+4}{(s+1)(s+5)}$ and hence obtain the state model in pole – zero form.

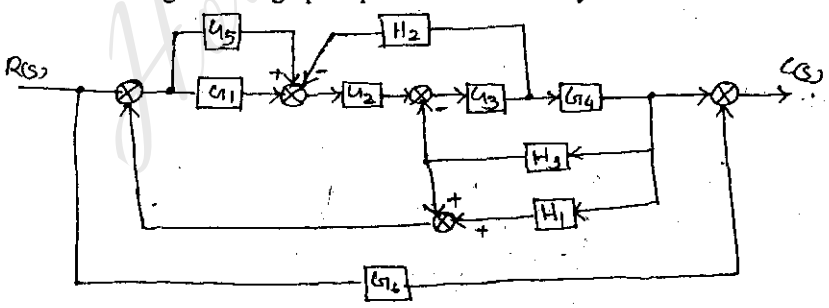
(h) State and explain Liapunov's main stability theorem.

PART – B

(4 x 15 = 60)

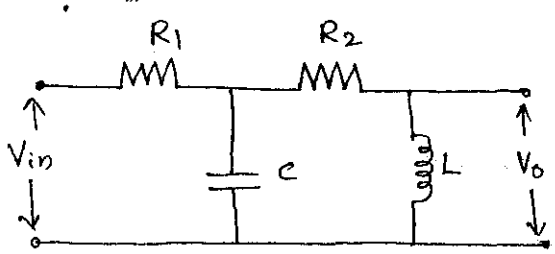
II. Obtain the transfer function $\frac{C(s)}{R(s)}$ of the system using block diagram reduction.

Also draw the signal flow graph representation of the system. (15)



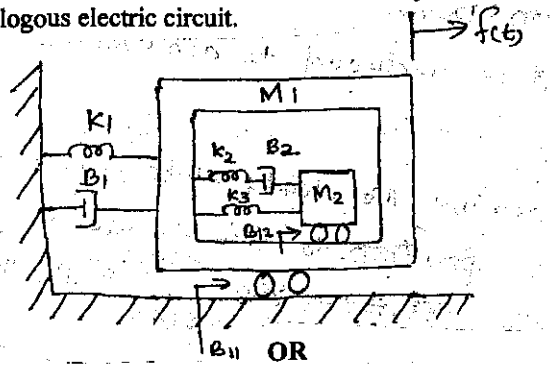
OR

III. Draw the block diagram representation and signal flow graph representation of the system shown. Find $\frac{v_o}{v_{in}}$ using signal flow graph. (15)



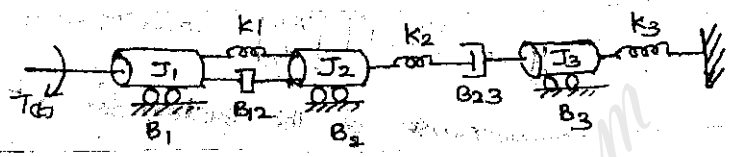
(Turn Over)

IV. Write the mathematical model of the mechanical system shown and draw the force voltage analogous electric circuit. (15)



OR

V. Write the dynamic equations for the mechanical system shown and draw the torque – current analogous electric circuit. (15)



VI. Obtain the step response of a second order system. (15)

OR

VII. (a) The maximum overshoot for a unity feed back linear system having its forward path transfer function as $G(s)=\dfrac{K}{S(ST+1)}$ is to be reduced from 60% to 20%. The system input is a unit step function. Determine the factor by which K should be reduced to achieve the above condition. (7)

(b) Determine the steady state error for the system whose open loop transfer function is given by

$$G(s)H(s)=\frac{250}{s^2+214s+40} \text{ for the input } r(t)=10+5t+\frac{6t^2}{2}.$$ (8)

VIII. A linear – time invariant system is characterized by the following state equation :

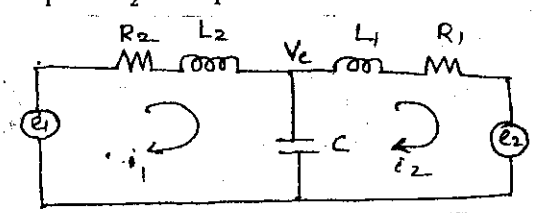
$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}X+\begin{bmatrix}0\\ 1\end{bmatrix}u(t)$$

$$y=\begin{bmatrix}1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} \text{ and } x_1(0)=1,\ x_2(0)=0$$

Obtain the time response of the system for unit step input. (15)

OR

IX. (a) Obtain the state model of the system shown in figure consider i_1, i_2 and v_c as state variables and i_1 and i_2 as output variables. (8)



(b) Determine the stability of the system having following characteristic equation :

$$s^6+s^5+5s^4+3s^3+2s^2-4s-8=0$$

using Routh Hurwitz criteria. (7)

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