

SE SEM IV (ETRX) (CBUS)  
PCS 04106114

QP Code : NP-19794

(3 Hours)

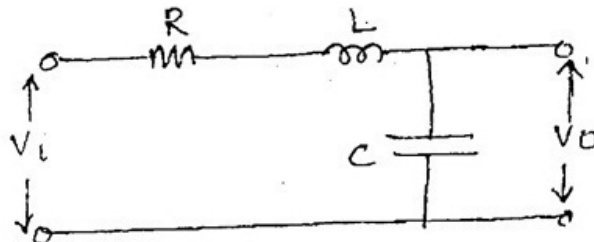
[ Total Marks : 80

- N.B. (1) Question No. 1 is compulsory.  
 (2) Attempt any three questions from remaining questions.  
 (3) Assume suitable data wherever necessary.

1. Attempt any four :-

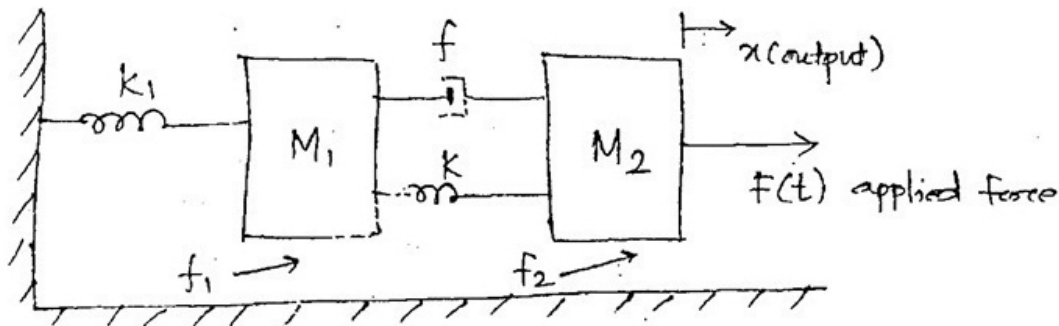
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- Differentiate between feedback and feed forward control system.
- What is a compensator? Why is it required?
- What are the properties of state transition matrix?
- Explain the concept of absolute, relative and robust stability.
- Find the transfer function for following network.



2. (a) Obtain the transfer function of the mechanical system.

10



(b) Consider unity feedback control system with an open loop transfer function of -

10

$$G(s) = \frac{k(s+1)(s+2)}{(s+0.1)(s-1)}$$

- Plot the root loci showing asymptotes, centroid, break away point, the gain at which root locus crosses  $j\omega$  axis.
- Find value of gain for which a closed system is critically damped.

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3. (a) A unity feedback control system is characterized by the open loop transfer function. 10

$$G(s) = \frac{k(s+13)}{s(s+3)(s+7)}$$

using the Routh criterion, calculate the range of values of k for system to be stable.

- (b) Write a note on advances in control systems. 10

4. (a) Obtain the state variable model of the transfer function— 10

$$\frac{Y(s)}{U(s)} = \frac{s^2 + 3s + 3}{s^2 + 2^2s + 3s + 1}$$

- (b) Sketch the Bode plot for the open loop transfer function given by— 10

$$G(s) H(s) = \frac{0.5(1+5s)}{s^2(1+0.5s)}$$

5. (a) Find rise time, settling time and peak overshoot for the system given by transfer function— 5

$$G(s) = \frac{25}{(s^2 + 8s + 25)}$$

- (b) Using Nyquist criterion, determine the closed loop system having following open loop transfer function is stable or not. If not, find number of poles in right half of s plane — 5

$$G(s) H(s) = \frac{1+4s}{s^2(1+s)(1+2s)}$$

- (c) Check controllability and observability for the system— 10

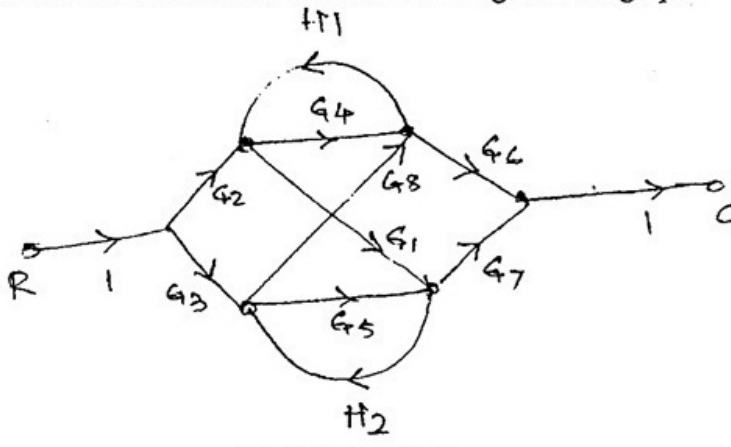
$$\dot{x} = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix} u$$

$$y = [1 \ 3 \ 0] x$$

6. (a) Explain the concept of on-off controller using example. 5

- (b) Compare lead-lag compensator. 5

- (c) Obtain the overall transfer function from signal flow graph. 10



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