SE SEM IV (ETRX) (CBGS)
PCS 04/06/14

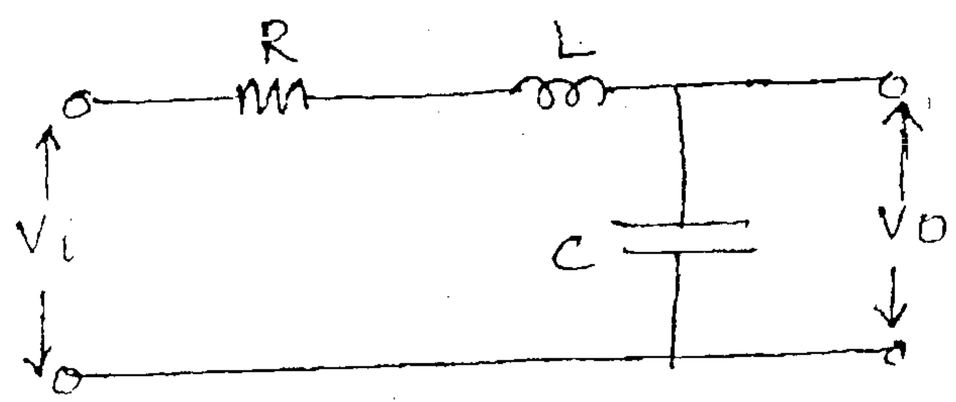
QP Code : **NP-19794**

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

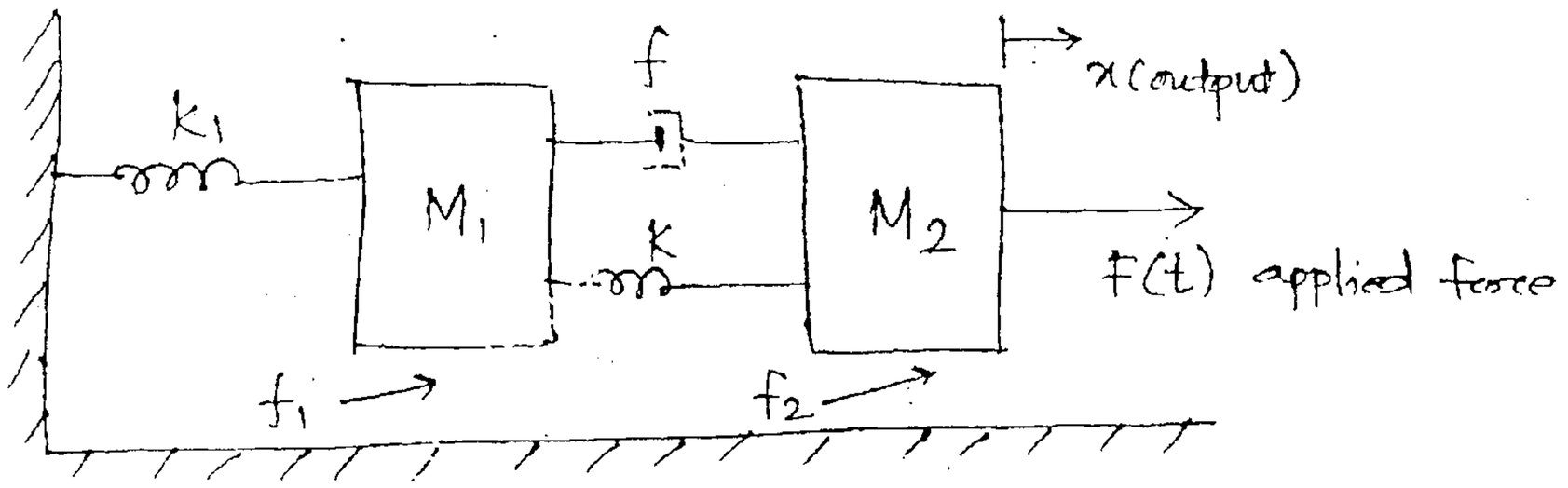
N.B. (1) Question No. **1** is **compulsory.**
(2) Attempt any **three** questions from remaining questions.
(3) Assume suitable data wherever **necessary.**

1. Attempt any **four** :– **20**

(a) Differentiate between feedback and feed forward control system.
(b) What is a compensator ? Why is it required ?
(c) What are the properties of state transition matrix ?
(d) Explain the concept of absolute, relative and robust stability.
(e) 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**

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

(i) Plot the root loci showing asymptotes, centroid, break away point, the gain at which root locus crosses jw axis.
(ii) Find value of gain for which a closed system is critically damped.

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**

$$G(s)\ H(s) = \frac{0{\cdot}5(1+5s)}{s^2(1+0{\cdot}5s)}$$

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**

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

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

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**