Code: EE5T2

III B.Tech - I Semester – Regular Examinations - November 2014

CONTROL SYSTEMS
(ELECTRICAL & ELECTRONICS ENGINEERING)

Duration: 3 hours   Marks: 5x14=70

Answer any FIVE questions.   All questions carry equal marks

1. a) Explain feedback characteristics of a closed loop systems.

7 M

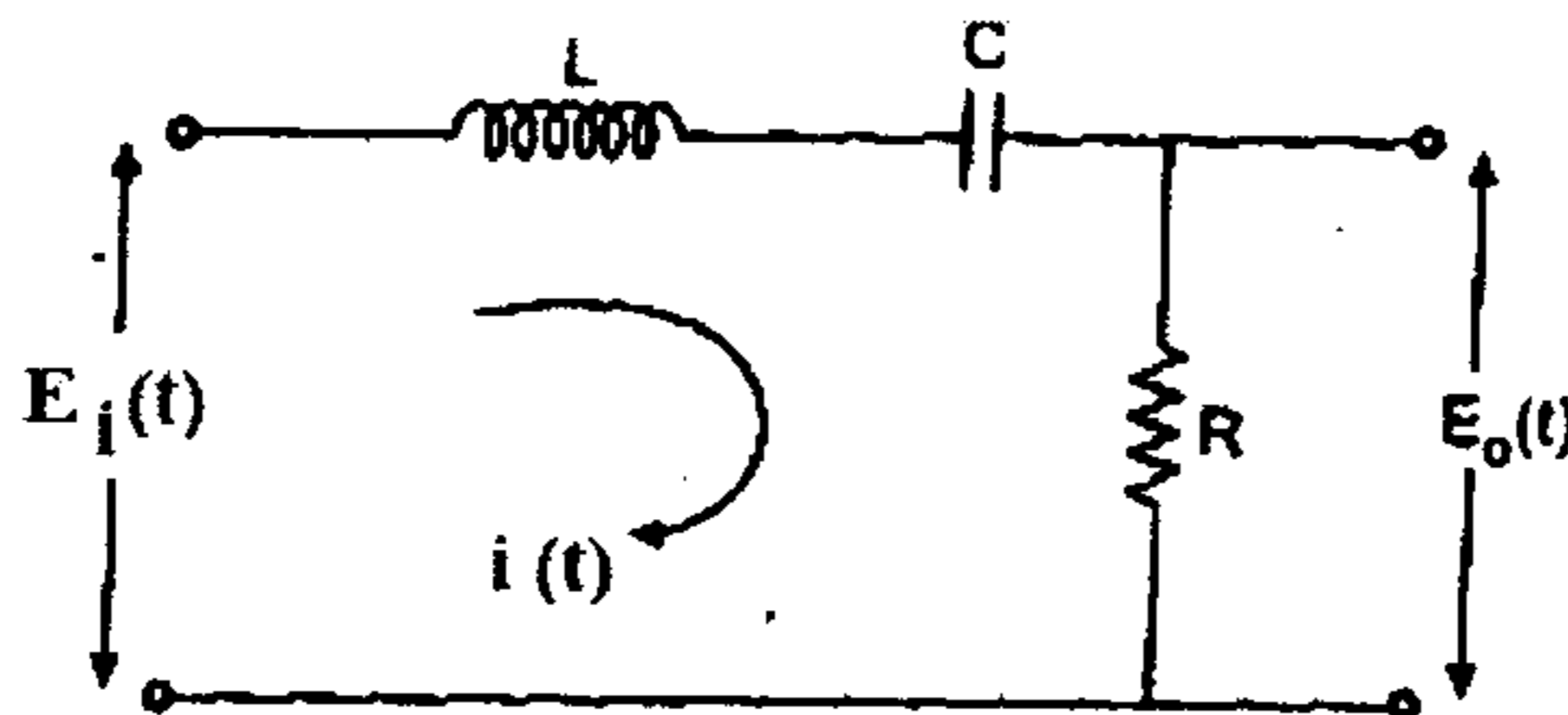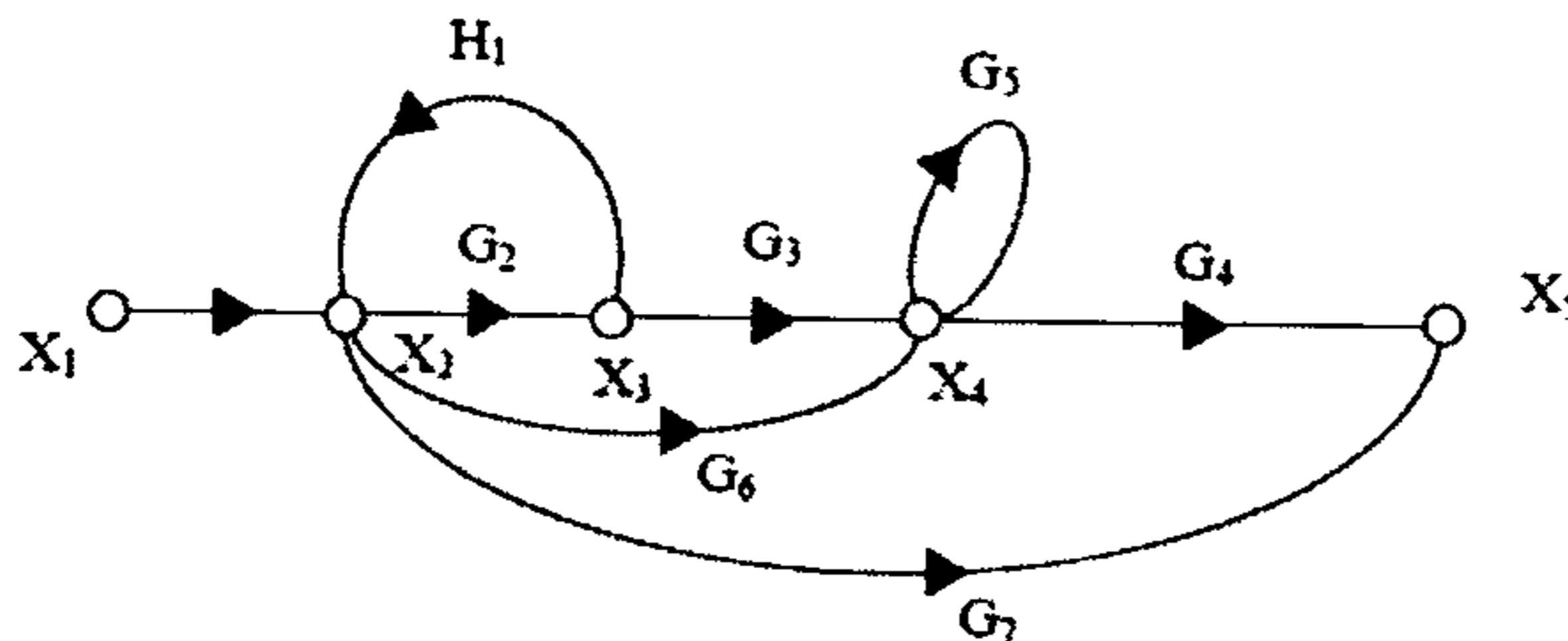b)Find the transfer function of the network given in figure 1

Figure 1   7 M

2. a) Derive the transfer function of dc servo motor   7 M

b) For the signal flow graph shown below, determine the gain X_5 / X_1 using Mason's gain formula   7 M

3. a) Why derivative controller is not used in control systems? What is the effect of PI controller on the system performance?   4 M

   b) A unity feedback control system is characterized by the following open loop transfer function
   $$G(s) = \frac{0.4s+1}{s(s+0.6)}.$$ Determine its transient response for a unit step input. Evaluate the maximum overshoot and the corresponding peak time.   10 M

4. a) Solve for y(t) for the following system represented in state space ,where u(t) is the unit step. Use the Laplace transform approach.   10 M
$$\dot{X} = \begin{bmatrix} -4 & 1 & 0 \\ 0 & -5 & 1 \\ 0 & 0 & 0 \end{bmatrix} X + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$$
$$Y = \begin{bmatrix} 1 & 1 & 0 \end{bmatrix} X; \qquad X(0) = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

   b) Explain the significance of state space Analysis.   4 M

5. a) Determine the range of values of K for the given system to be stable.   4 M
   $$s^4+4s^3+13s^2+36s+K=0$$

   b) Draw the root locus for the unity feedback system whose open loop transfer function is $G(s) = \dfrac{k(s+1)}{(s-1)(s+2)(s+4)}$. Find the range of k for which the system is stable.   10 M

6. a) Distinguish between polar plots & Nyquist plots.   6 M

    b) Discuss the effect of adding poles & zeros to G(s)H(s) on
      the shape of Nyquist plots   8 M

7. a) Define   4 M
     i. Minimum phase transfer function
     ii. Non minimum phase transfer function

    b) Enlist the steps for the construction of Bode plots.   10 M

8.   Design a lead compensator for unity feedback system
      whose open loop transfer function $G(s) = \dfrac{k}{s(s+1)(s+5)}$ to
      satisfy the following specifications.
         i) Velocity error constant $K_v \geq 50$
         ii) Phase margin $\geq 20^0$.   14 M