C 14830 (Pages : 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2010

EE 2K 603—CONTROL SYSTEMS—I

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

1. (a) Draw the analogous system using Force-voltage analog».

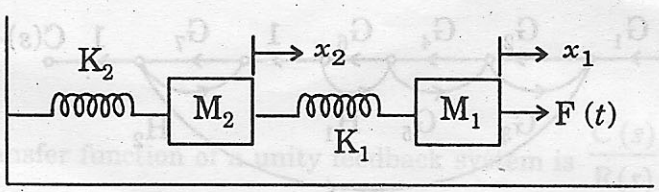

Fig. 1.

(b) Obtain the transfer function $\frac{I_2(s)}{V(s)}$ in the following circuit Fig. 2 :—

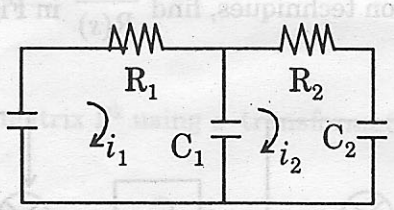

Fig. 2.

(c) Find the z-transform of $\frac{1}{(s+a)^2}$.

(d) Draw the block diagram for the sample data control system and explain.

(e) Define Rise time, Peak time and Settling time.

(f) Describe the procedure for finding stability of a discrete time system using bilinear transformation.

(g) Describe what is polar plot.

(h) Explain about Nichol's chart.

(8 × 5 = 40 marks)

Part B

2. (a) Find $\frac{C(s)}{R(s)}$ from the signal flow graph below in Fig. 3.

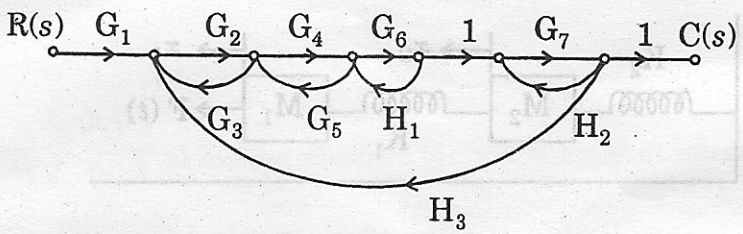

Fig. 3.

Or

(b) Using block diagram reduction techniques, find $\frac{C(s)}{R(s)}$ in Fig. 4.

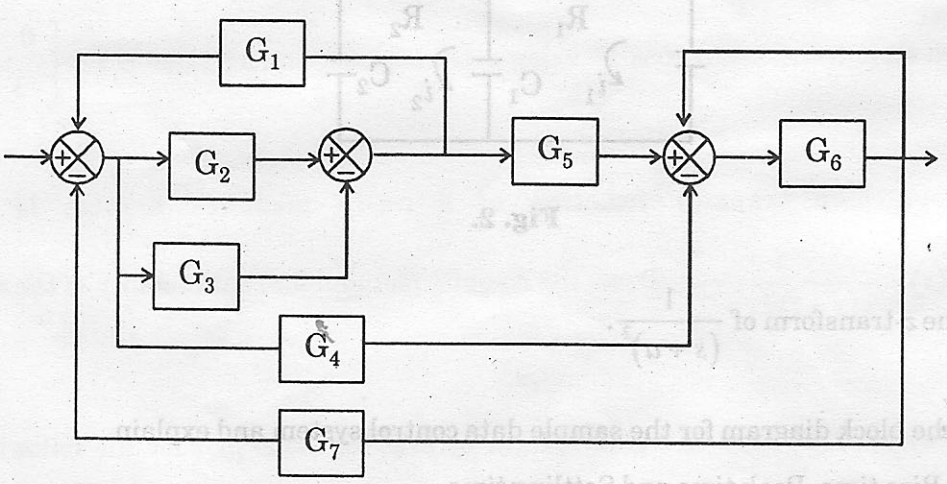

Fig. 3.

3. (a) (i) Describe about zero order and first order hold circuits. (8 marks)

(ii) Find the discrete time state equation for the following system. (Controllable canonical form $y(k+3)+5y(k+2)+7y(k+1)+3y(k)=0$.

(7 marks)

Or

(b) Obtain the transfer function description for the following system :—

$$\begin{bmatrix} x_1(k+1) \\ x_2(k+2) \end{bmatrix} = \begin{bmatrix} 2 & -5 \\ \frac{1}{2} & -1 \end{bmatrix} \begin{bmatrix} x_1(k) \\ x_2(k) \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u(k)$$

$$y(k) = 2x_1(k).$$

4. (a) The overall transfer function of a unity feedback system is $\frac{C(s)}{R(s)} = \frac{10}{s^2+6s+10}$. Find the values of steady state error constants. Also find steady state error for an input $r(t) = 1+t+t^2$.

Or

(b) (i) Determine the stability of the system which has the characteristic equation $s^6+2s^5+8s^4+15s^3+20s^2+16s+16=0$.

(10 marks)

(ii) Find state transition matrix F^k using z- transformation technique if $F = \begin{bmatrix} 0 & 1 \\ -3 & 4 \end{bmatrix}$.

(5 marks)

5. (a) The open loop transfer function of a unity feedback system is given by $G(s)H(s) = \frac{5}{s(s+1)(s+2)}$. Draw the Nyquist plot and find out stability of the system.

Or

(b) Determine phase margin and gain margin by drawing Bode plot for the following system.

$$G(s) = \frac{22.5}{(s+4)(s^2+0.9s+9)}.$$

(4 × 15 = 60 marks)