1. Consider the following discrete system 20%

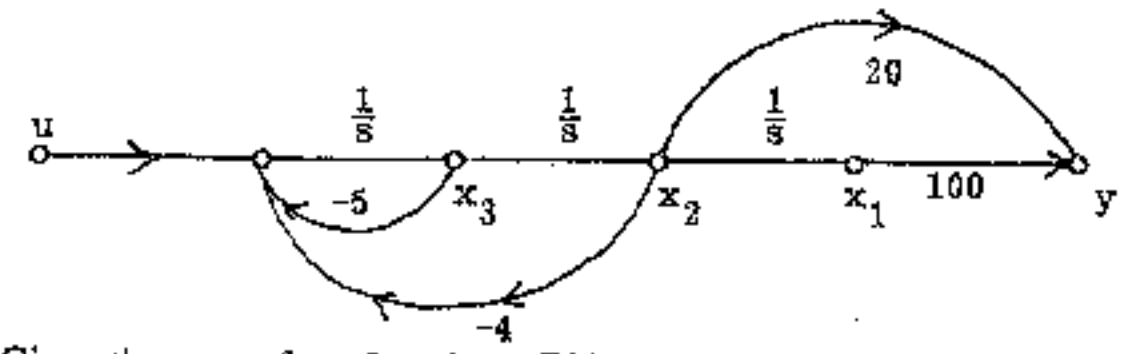
$$x(k+1) = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k)$$

$$y = [0 \quad 1]\, x(k)$$

a. Find the dead-beat control u(k) (i.e., with all poles at z=0)

b. Design the dead-beat observer.

2. Consider the following system 20%



a. Give the transfer function G(s) and state space model.

b. Design the state feedback u=-kx so that the eigenvalues of the closed loop are at -5.4±j7.2 and -5.1

3. Consider the following system: 20%

$$\dot{x} = -x^3$$

Determine the stability near the origin via Lyapunov's direct method.

八十四學年度 電機 所 乙 組碩士班研究生入學考試

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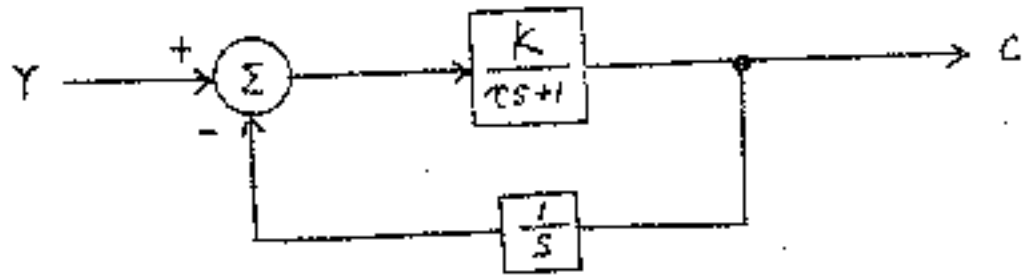
4. If the desired ideal transfer function of the feedback system as shown is $T_d(s) = s$ (a differentiator); find the step, ramp and parabolic error constants for this system. 20%



5. In the digital control system block diagram as shown, T is the sampling interval and B is the backshift operator (equivalently $B=z^{-1}$): 20%
   (1) Find the range of sampling interval (T) in which the closed-loop system is absolute stable.
   (2) Select a value of K_c that results in dead-beat response of c_n to step change in the disturbance p_n.