招生學年度	103	招生類別	碩士班
系所班別	電機光電碩士班聯合招生（電機工程學系碩士班、電機工程學系 電子工程碩士班、光電工程學系碩士班）		
科目名稱	控制系統		
注意事項	本考科可使用掌上型計算機		

1. (10%) Find the transfer function, $T(s) = \frac{C(s)}{R(s)}$, for the system shown in Figure 1.

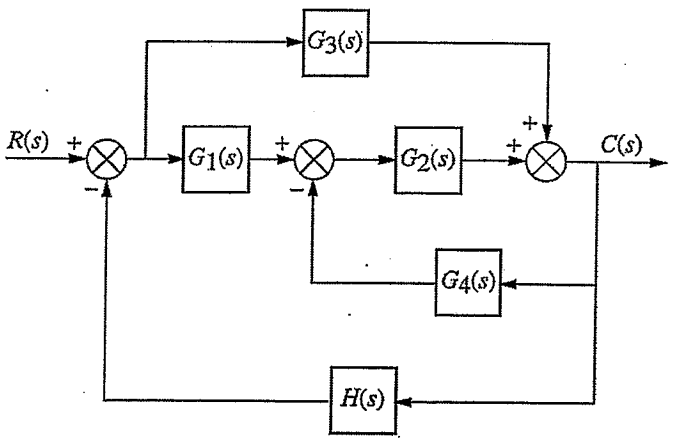

Figure 1.

2. (15%) Design the values of K_1 and K_f in the system of Figure 2 to meet the following specifications: (i) the velocity error constant $K_v = 10$; (ii) the damping ratio ζ=0.5.

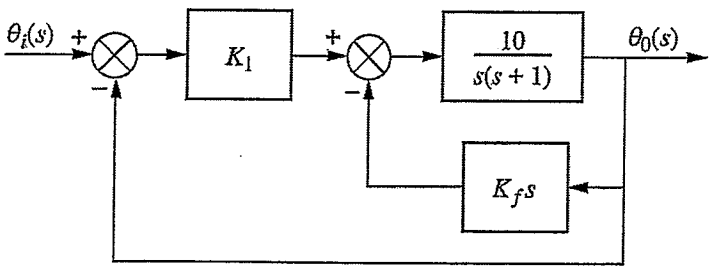

Figure 2.

3. Consider the system shown in Figure 3.
   (a) (5%) Use the Routh-Hurwitz criterion to find the range of K for closed-loop stability.
   (b) (5%) What is the system type?
   (c) (5%) What is the steady-state error for a unit step input?

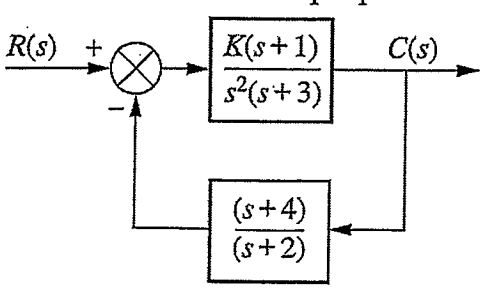

Figure 3.

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4. (10%) Using the Routh-Hurwitz criterion, determine whether the unity feedback system of Figure 4 is stable if

$$G(s) = \frac{24}{s(s^3 + 9s^2 + 28s + 38)}$$

and tell how many closed-loop poles are in the left half plane of $s = -2$ (poles with real part less than -2).

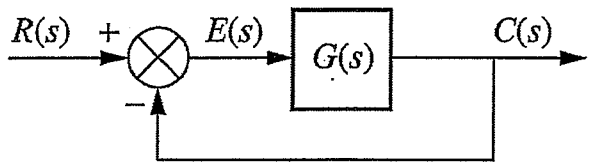

Figure 4.

5. (20%) Consider the following transfer-function system:

$$\frac{Y(s)}{U(s)} = \frac{2s^2 + 6s + 5}{(s+1)^2(s+2)}$$

Use the parallel decomposition method to represent the above system in the state-variable Jordan canonical form.

6. (10%) Give a control system in the following:

$$\dot{x}(t) = \begin{bmatrix} 0 & 50 \\ -200 & -200 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 200 \end{bmatrix} u(t) + \begin{bmatrix} -50 \\ 0 \end{bmatrix} d(t), \quad y(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} x(t),$$

$$\dot{z}(t) = r(t) - y(t), \qquad u(t) = \begin{bmatrix} k_1 & k_2 \end{bmatrix} x(t) - k_3 z(t)$$

If the eigenvalues of the closed-loop system are at $s = -300,\ -10 \pm j10$, find $k_1, k_2,$ and k_3.

7. (20%) Explain the following phrases.
   (a) Completely observable.
   (b) Full-order state observer.
   (c) Rise time.
   (d) Settling time.