招生學年度	105	招生類別	碩士班
系所班別	電機工程學系碩士班		
科目名稱	自動控制		
注意事項	本考科可使用掌上型計算機		

1. (20%) Given the unity feedback system of Figure 1

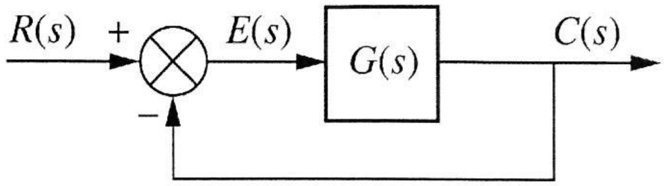

Figure 1

(a) Determine whether the sytem is stable if

$$G(s) = \frac{240}{(s+1)(s+2)(s+5)(s+6)}$$

(b) If

$$G(s) = \frac{K(s+1)}{s^4(s+2)}$$

find the range of K for stability.

2. (20%) Given the unity feedback system of Figure 1, where

$$G(s) = \frac{K(s+1)}{s(s+2)(s+3)(s+5)}$$

do the following:

(a) Sketch the root locus

(b) Find the value of gain that will make the system marginally stable.

(c) Find the value of gain for which the closed-loop transfer function will have a pole on the real axis at -0.5.

3. (20%) Consider the system shown in Figure 2.

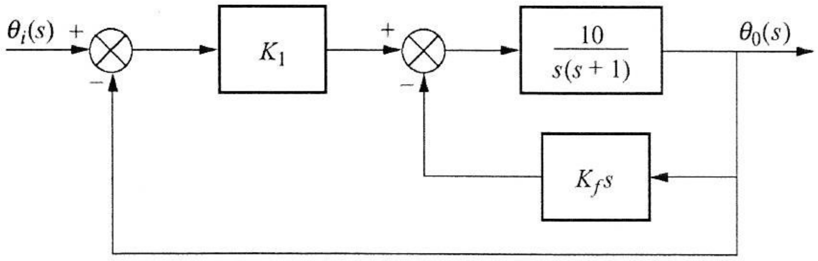

Figure 2.

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(a) Find the transfer function $\theta_o(s)/\theta_i(s)$.

(b) Find the values of K_1 and K_f to meet the following specifications: velocity error constant, $K_v = 10$, and damping ratio, $\zeta = 0.5$.

4. (20%) A system is shown in the following Figure 3.

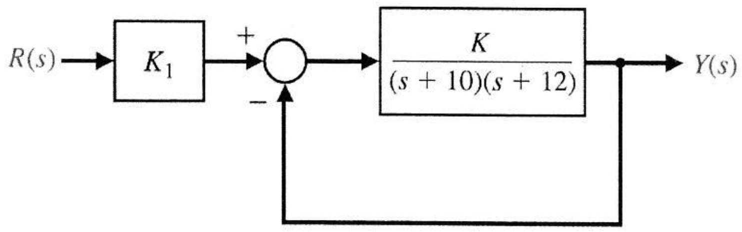

Figure 3

(a) Let $K_1 = 1$. Determine the minimum value of K so that for the unit-step input the steady-state error, $e_{ss} \leq 0.25$, where $E(s) = R(s) - Y(s)$.

(b) With the minimum value of K found in Part (a), select K_1 so that the steady-state error is zero.

5. (20%) A control system has two forward paths, as shown in Figure 4.

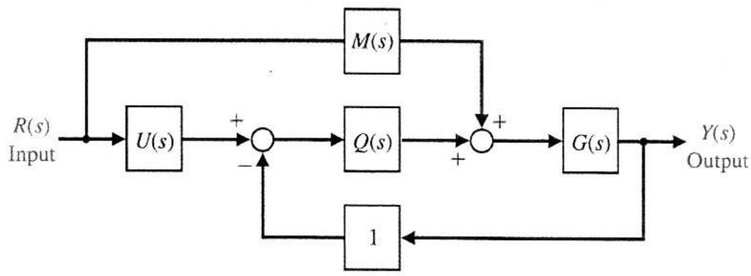

Figure 4.

(a) Determine the overall transfer function $T(s) = Y(s)/R(s)$.

(b) Calculate the sensitivity $S_G^T = \frac{\partial T}{\partial G}\frac{G}{T}$.

(c) Does the sensitivity depend on $U(s)$ or $M(s)$?