國立成功大學 107 學年度碩士班招生考試試題

系　　所：製造資訊與系統研究所

考試科目：自動控制

考試日期：0205，節次：1

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Consider the feedback control system shown in Figure 1. Find the following. (25%)
   (a) For $K_1>0$ and $K_2>0$, what are the ranges of K_1 and K_2 that make the system stable.
   (b) Find the values of K_1 and K_2 to yield a peak time of 1.5 seconds and a settling time of 3.2 seconds for the closed-loop system's step response.

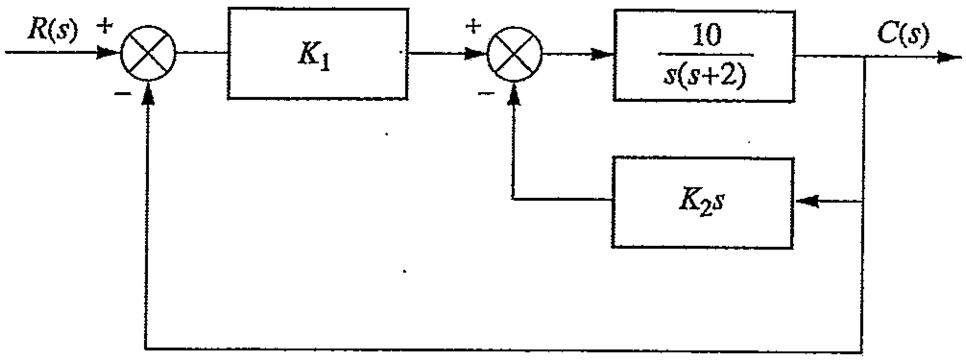

Figure 1. Closed-loop control system for Problem 1.

2. Consider a unit-feedback control system whose transfer function of the plant is

$$G(s)=\frac{2}{s^3+4s^2+5s+2}$$

Find the following. (20%)
   (a) The system type and steady-state error with unit-step input.
   (b) For the system, which of the following controllers, P-controller (K_P), PD-controller (K_P and K_D), and PI-controller (K_P and K_I), can be utilized to eliminate the steady-state error in part (a)? What is the steady-state error unit-step input?
   (c) For your choice of controller in part (b), what are the range of the control gains that make the system stable?

3. Consider a closed-loop system where

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

Find the following. (30%)

(a) Plot the root locus of the system.

(b) Use Routh-Hurwitz to find the range of K that makes the system stable.

(c) Find the frequency of oscillation when the system is marginally stable.

(d) For unit-step input with $K=1$, find the steady-state error of the system.

(e) If the steady-state error in part (d) is not zero, can you design a compensator with type 1 to reduce steady-state error with unit-step input. Explain your result by plotting the root locus.

4. Consider a unit-feedback control system whose forward transfer function is

$$G(s)=\frac{K}{s(s+3)(s+4)(s+8)}$$

Find the following. (25%)

(a) Sketch the Nyquist diagram of the system.

(b) Gain and phase margins of the system