國立臺灣師範大學 100 學年度碩士班招生考試試題

科目：**自動控制**　　　　　　　　適用系所：**機電科技學系**

注意：1.本試題共 2 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則不予計分。

1.Given the electrical network of Figure 1,

(1)Find the state-space representation if the output is the current through the resistor.(10 分)

(2)Find the input-output transfer function relating the current through the resistor, I_R(s), to the input voltage , V(s).(10 分)
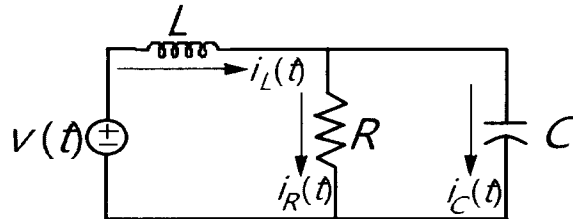

Figure 1.

2.Consider a DC motor speed control system of Figure 2, where D(s)=K、$G(s) = \dfrac{1}{s+2}$、and

$H(s) = \dfrac{2}{s+4}$, determine an appropriate gain K so that the whole system steady-state error to a unit step input is minimized.(10 分)
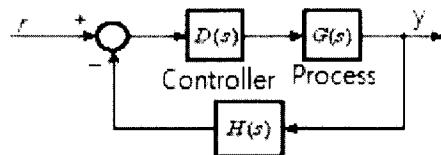

Figure 2.

3. Fgiure 3 shows a thermal control system in which hot air is circulated to keep the temperature of a chamber constant. The transfer function of the plant can be adequately represented by $\dfrac{\theta(s)}{U(s)} = \dfrac{1}{s+1}$.

(1)What are the functions of the controller in this system?(5 分)

(2)Determine the values of K_1 and K_2 which meet the following specification on the feedback system: maximum overshoot $M_p \leq 20\%$, setting time ts$\leq$2sec.(15 分)
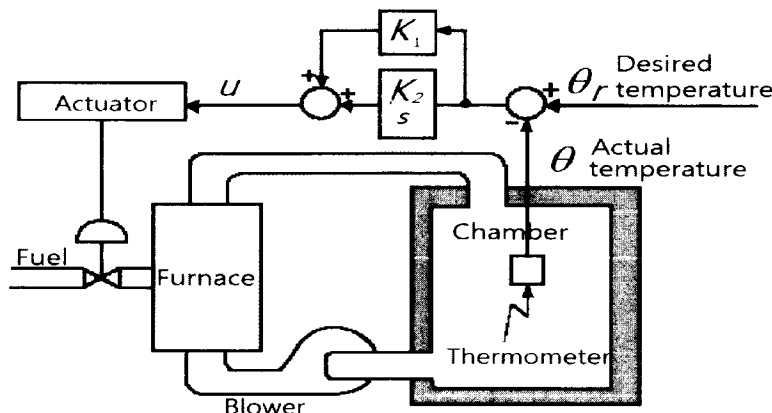

Figure 3.

4.Suppose system $Y(s) = \dfrac{(s+10)}{s^2+2s+5}R(s)$ and $R(s) = \dfrac{1}{s}$. Please determined the peak time (t_p), and the

maximum overshoot(M_p), where $\dot{y}(t = t_p) = 0$ and $M_p = y(t_p) - 1$. (10 分)

5.A single-loop feedback controlled system has a characteristic equation, $1+G(s)H(s)=0$ with

$G(s)H(s) = \dfrac{K}{s(s+1)(s+5)}$; $K\geq 0$.

(1)Please sketch the root locus of this system.(15 分)

(2)What is the change of the root locus when add a zero (s+3) in the original system?(3 分)

(3)What is the change of the root locus when add a zero (s+10) in the original system?(3 分)

6.Figure 4 shows the system frequency response data on Bode plots.

(1)Find: (a)gain crossover frequency ω_g, (b)gain margin $G.M.$, (c)phase crossover frequency ω_ϕ, and
    (d)phase margin $P.M.$(12 分)

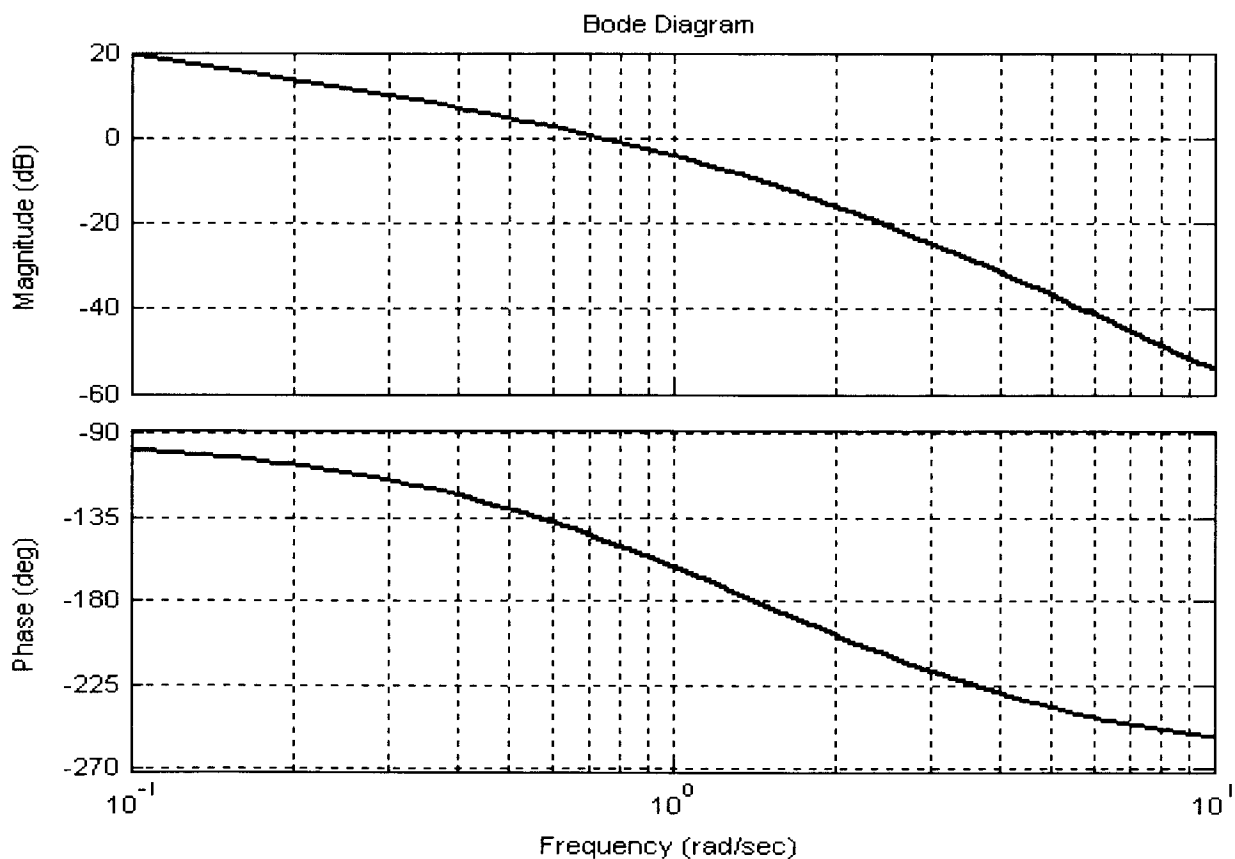(2)Assume that the system has minimum phase transfer function, estimate the transfer function.(7 分)

Figure 4