國立臺灣師範大學100學年度碩士班招生考試試題

科目：控制系統　　適用系所：應用電子科技學系

注意：1.本試題共 3 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. (共 20 分) A single-input, single-output system has the matrix equations

$$\dot{\mathbf{x}}(t) = \begin{bmatrix} 0 & 1 \\ -2 & -2 \end{bmatrix}\mathbf{x}(t) + \begin{bmatrix} 1 \\ 1 \end{bmatrix}u(t).$$
$$y(t) = \begin{bmatrix} 2 & 3 \end{bmatrix}\mathbf{x}(t)$$

(a). Find the unit-step response of system. (10 分)

(b). Determine the transfer function $G(s) = \dfrac{Y(s)}{U(s)}$. (10 分)

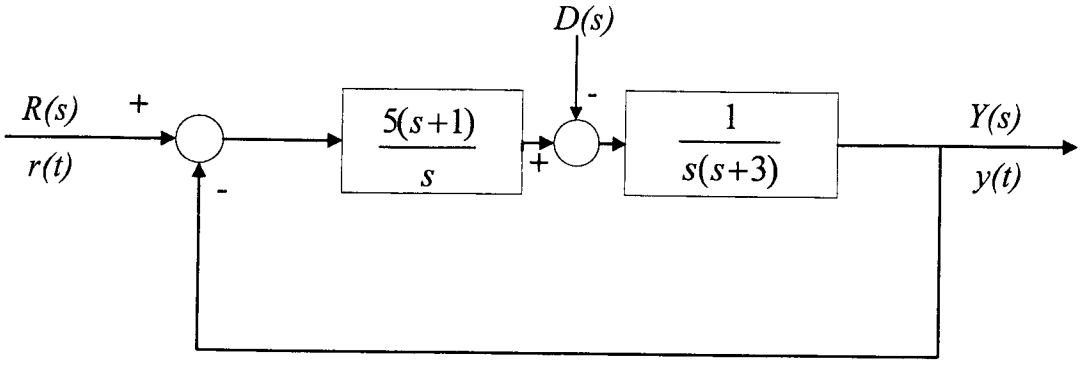
2. (共 20 分) A machine tool shown below is designed to follow a desired path

$$r(t) = (2 - t + 0.5t^2)u(t)$$

where $u(t)$ is the unit-step function.

(a). Determine the steady-state error when $r(t)$ is the desired path as given and $D(s)$=0. (10 分)

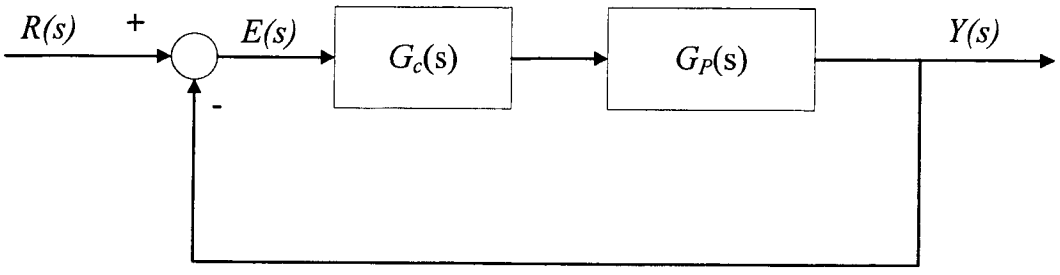
(b). If the desired input is $r(t)$=0, find the steady-state error when $D(s)$=1/s. (10 分)



3. (15 分) Consider the control system shown below, where the controller G_c(s) and plant $G_p(s)$ are as follows:

$$G_c(s) = \frac{K(s+a)}{(s+1)}, \qquad G_P(s) = \frac{1}{s(s+2)(s+3)}.$$

Determine the range of K and a for which the system is stable by using the Routh-Hurwitz stability criterion.



4. (共 20 分) Consider the following loop transfer function

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

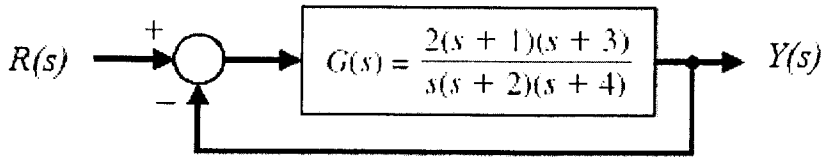
(a). Plot the Nyquist diagram for the system. (10 分)

(b). Use the Nyquist criterion (based on Nyquist diagram) to determine the stable range for K. (10 分)

5. (共 10 分) A single-loop control system is shown below.

(a). Plot the phase variable flow graph state model. (5 分)

(b). Determine the phase variable state model (i.e., phase variable canonical form) for the system. (5 分)



6. (15 分) The magnitude plot of a transfer function

$$G(s)=\frac{K(1+0.5s)(1+as)}{s(1+s/8)(1+bs)(1+s/36)}$$

is shown below. Determine K, a, b from the plot.