淡江大學 98 學年度碩士班招生考試試題

系別：電機工程學系控制晶片與系統組　　科目：控制系統

電機工程學系機器人工程碩士班

準帶項目請打「V」	
V	簡易型計算機

本試題共 1 頁 5 大題

1. Consider the electrical circuit in Figure 1. (i) Find the transfer function from the input voltage $v(t)$ to the capacitor voltage. (10%) (ii) Find the capacitor voltage when $v(t)$ is a unit step function. (10%)

2. Find a state space representation for the two-input one-output system $T(s)=\begin{bmatrix}\dfrac{s+1}{s} & \dfrac{1}{s^2+5s+4}\end{bmatrix}$. (10%)

3. Consider a system represented by the following equations:

$\dot{x}=\begin{bmatrix}0 & 1\\ a_1 & a_2\end{bmatrix}x+\begin{bmatrix}0\\ 1\end{bmatrix}u$, $y=\begin{bmatrix}1 & 0\end{bmatrix}x$, where u and y denote the input and output, respectively.

(i) Find the values of the parameters a_1 and a_2 so that the unit step response of the system, assuming $x(0)=[0\ 0]^T$, has the following properties: 12% percent overshoot and 0.6 second settling time. (10%)

(ii) Assume $a_1=0$, $a_2=0$, $x(0)=[1\ 0]^T$, and $u(t)=\sin(t)$, find the output $y(t)$. (10%)

4. Consider the unity feedback system in Figure 2 where $G(s)=\dfrac{K}{(s+10)(s^2+4s+5)}$.

(i) Find the range of K to make the feedback system stable. (10%)

(ii) Find the closed-loop poles of the feedback system when $K = 580$. (10%)

5. Consider the system shown in Figure 3. (i) Derive the expression for the error, $E(s)=R(s)-H(s)C(s)$, in terms of $R(s)$ and $D(s)$. (10%) (ii) Assuming closed-loop stability, derive the steady-state error $e(\infty)$ if both $R(s)$ and $D(s)$ are unit step functions. (10%) (iii) Assume $G_2(s)=1$. Give a numerical example for $G_1(s)$ and $H(s)$ so that the closed-loop system is stable and $e(\infty)=0$ when both $R(s)$ and $D(s)$ are unit step functions. (10%)

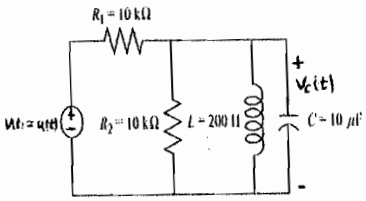

Figure 1

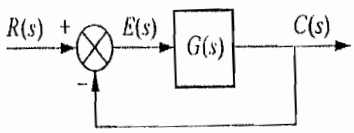

Figure 2

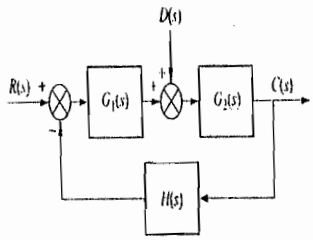

Figure 3