國立雲林科技大學
96學年度碩士班入學招生考試試題 乙組
系所：電機系
科目：自動控制

共7題，合計100分，請依序作答，否則不計分。

1. A discrete system is described by the dynamic equation (state equations and output equation)

$$x(k+1)=\begin{bmatrix}0 & 1\\ -3 & 4\end{bmatrix}x(k)+\begin{bmatrix}0\\ 1\end{bmatrix}u(k)$$
$$y(k)=\begin{bmatrix}1 & 1\end{bmatrix}x(k)$$

(i) Find the state transition matrix $\Phi(k)=?$ (10%)

(ii) Find the solution $y(k)$ if $x(0)=\begin{bmatrix}x_1(0)\\ x_2(0)\end{bmatrix}=\begin{bmatrix}0\\ 0\end{bmatrix}$ and $u(k)=1,\ k\geq 0$. (10%)

2. Find the input-output differential equation to describe the RLC network in Figure1, where $u(t)$ and $y(t)$ are the input voltage source and output voltage of C, respectively. (15%)

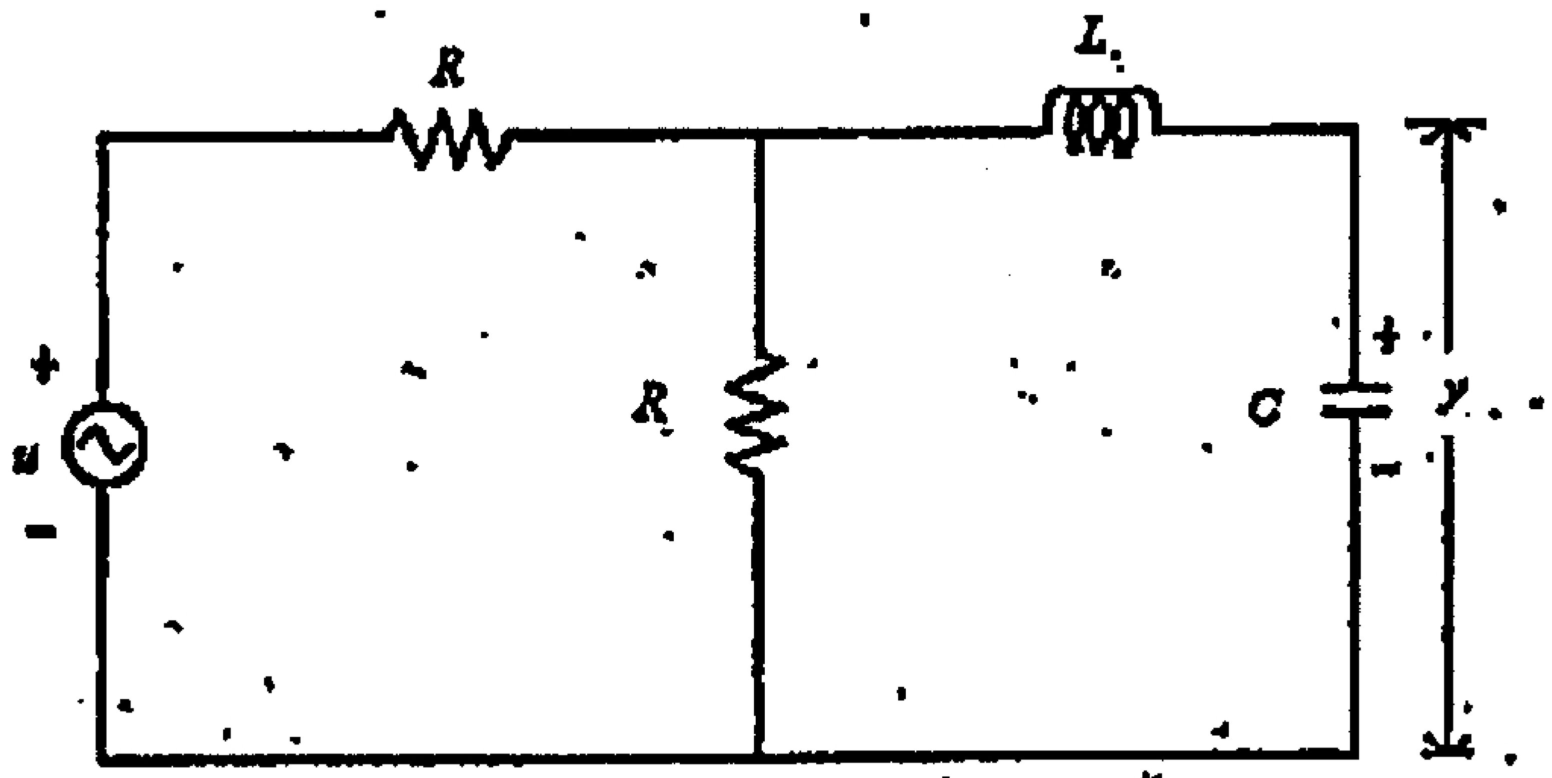

Figure 1

3. Consider a linear time-invariant system of the closed loop transfer function $G_0(s)=\dfrac{Y(s)}{U(s)}=\dfrac{2}{s+1}$, where $u(t)$ and $y(t)$ denote the input and the output, respectively. Find the steady state responses $y(\infty)$ when $u(t)=1+2\cos(t)$.

(15%)

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4. For the transfer function below, find how many poles are in the right half-plane, and on the $j\omega$-axis. (10%)

$$T(s)=\frac{K}{s^7+s^6+2s^5+2s^4-s^3-s^2-2s-2}$$

5. Given the unity feedback system shown as Figure 2, where

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

solve the following problem: (15%)

(a) Sketch the Nyquist diagram(mapping only the positive $j\omega$-axis). (10%)

(b) Find the gain margin with k =10. (5%)

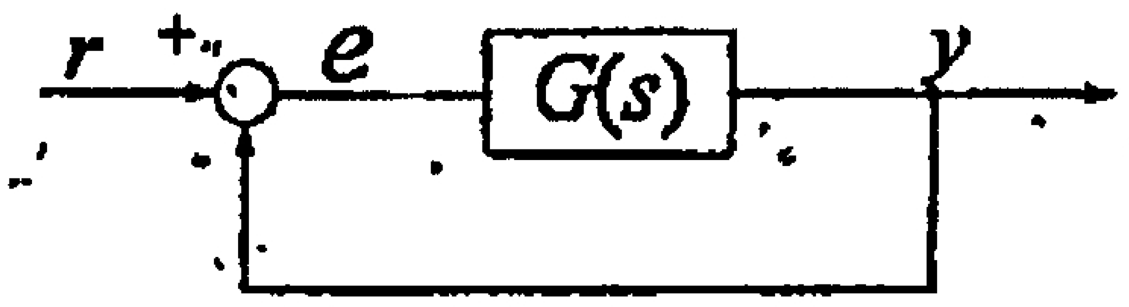

Figure 2.

6. Consider the dynamical system, $\frac{dx}{dt}=Ax(t)+bu(t)$,

where $A=\begin{bmatrix}0 & -1\\ 5 & 0\end{bmatrix}$ and $b=\begin{bmatrix}1\\ -2\end{bmatrix}$

Find the control $u(t)=-kx(t)$, such that the desired poles are located on $-1 \pm j1$. (15%)

7. Check the controllability and observability of

$$\frac{dx}{dt}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 0 & 2 & -1\end{bmatrix}x(t)+\begin{bmatrix}0 & 1\\ 1 & 0\\ 0 & 0\end{bmatrix}u(t) \quad (10\%)$$

$$y(t)=\begin{bmatrix}1 & 0 & 0\end{bmatrix}x(t)$$