國立臺北科技大學 103 學年度碩士班招生考試

系所組別：1320 車輛工程系碩士班乙組

第二節　自動控制　試題

注意事項：

1. 本試題共 4 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (20%) A unity-feedback system has feedforward transfer function

$$\frac{k(s^2+2s+3)}{s^3}$$

Please sketch the closed loop root locus step by as k varying from 0 to ∞.

2. (20%) Give a system with transfer function as

$$g(s)=\frac{4s^2+25s+38}{s^3+9s^2+26s+24}$$

If the state-space representation of this system is

$$\dot{X}=\begin{bmatrix}-2 & 0 & 0\\ 0 & a & 0\\ 0 & 0 & b\end{bmatrix}X+Gu \qquad y=[1 \quad 1 \quad 1]X$$

Please find a,b,G.

3. Given the following plant

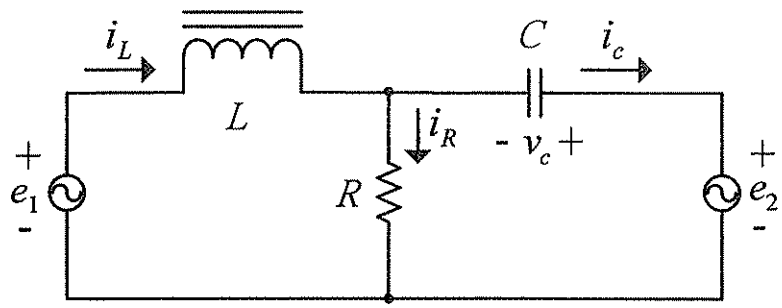
$$G(s) = \frac{20(s+5)}{s(s+1)(s+4)}$$

(1) (10%) Please find the system's state-space equation. i.e.

$$\dot{x} = Ax + Bu \qquad y = Cx$$

(2) (10%) Please find a state feedback $u=Kx$ to yield a 9.48% overshoot and a settling time of 0.74 seconds (in this case, the closed loop system has a desired characteristic equation $s^3+15.9s^2+136.08s+413.1=0$).

4. An *RLC* network is shown in the following figure. Define the state variable as $x_1(t)=i_L(t)$, $x_2(t)=v_c(t)$ and the outputs as $y(t)=v_c(t)$.



(1) (10%) Determine the differential equations. (Using KCL and KVL)

(2) (10%) Obtain the dynamical equation.

(3) (10%) Draw the state model flow graph.

(4) (10%) Find the transfer functions $\frac{Y(s)}{E_1(s)}$ and $\frac{Y(s)}{E_2(s)}$.