113AT02

國立臺北科技大學113學年度碩士班招生考試

系所組別：1501 自動化科技研究所

第二節　自動控制　試題（選考）

注意事項：

1. 本試題共 5 題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
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. Find the Laplace transform of the following function. (25% in total)

(1) The function $f(t)$ is shown in Fig. 1. (10%)

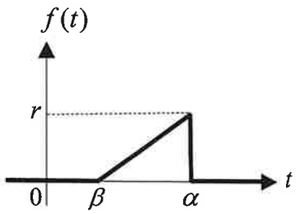

Fig. 1

(2) The function $g(t)=0.5t$ is defined on $0\le t\le 2$ and $g(t+2)=g(t)$. (15%)

2. Given the following forward-path transfer function of unity-feedback control systems. Find the range of K so that the unity-feedback control systems is stable. (20% in total)

(1) $G(s)=\dfrac{K}{s(s+3)(s^2+s+1)}$ (10%)

(2) $G(s)=\dfrac{K(s+9)(s+15)}{s^2(s+2)}$ (10%)

3. The unity-feedback control system is shown in Fig. 2. (20% in total)

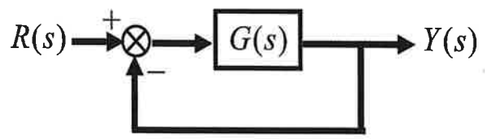

Fig. 2

(1) Please determine the steady-state error e_{ss} for a unit step input and a unit ramp input when $G(s)=\dfrac{10}{s^2+12s+30}$ (14%)

(2) Please determine the steady-state error e_{ss} for a unit step input and a unit ramp input when $G(s)=\dfrac{s-9}{s^2+5s+6}$ (6%)

4. The control system is shown in Fig. 3. (20% in total)

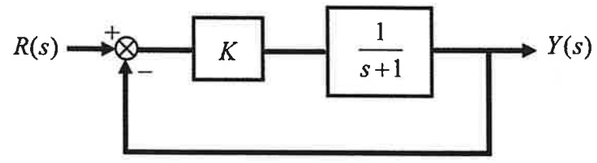

Fig. 3

(1) Please determine the closed-loop transfer function $\dfrac{Y(s)}{R(s)}$. (5%)

(2) Please determine K so that the closed-loop bandwidth is $\omega=5$ rad/sec. (15%)

注意：背面尚有試題

5. Consider the plant model $\dot{x}(t) = Ax(t) + Bu(t)$, $y(t) = Cx(t)$, where

$$A = \begin{bmatrix} 0 & 1 \\ -2 & -1 \end{bmatrix}, \; B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \; C = \begin{bmatrix} 1 & 0 \end{bmatrix}. \qquad \text{(15\% in total)}$$

(1) If $u(t) = r(t) - Kx(t)$, $K = \begin{bmatrix} k_1 & k_2 \end{bmatrix}$, where k_1 and k_2 are real constants. Determine how K affects the controllability of the closed-loop system. (5%)

(2) Determine a full state observer $L = \begin{bmatrix} \ell_1 \\ \ell_2 \end{bmatrix}$, where ℓ_1 and ℓ_2 are real constants. Place the eigenvalues of the observer at $s = -10$. (10%)