國立臺北科技大學 101 學年度碩士班招生考試

系所組別：1512 自動化科技研究所甲組

第二節　自動控制　試題（選考）

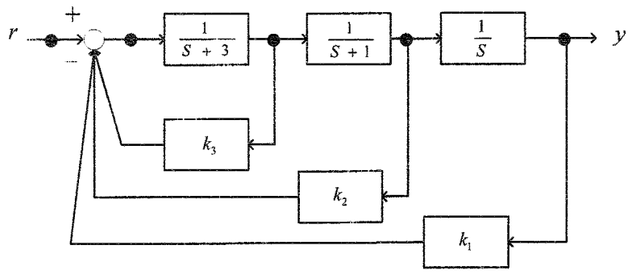
注意事項：

1. 本試題共五題，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。

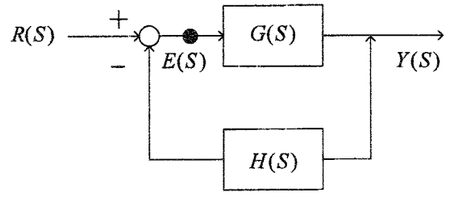
1. Determine the controller gains k_1, k_2, and k_3 for the system such that the following two conditions are satisfied. (15%)

i.The steady state error e_{ss} due to a step input is zero. $(e = r - y)$

ii.The complex roots of the characteristic equation are $-1 \pm j$.



2. Consider a closed-loop system shown in the following figure



where $G(S) = \dfrac{64K}{S(S+4)(S+16)}$, $H(S) = 1$ and $E(S) = R(S) - Y(S)$

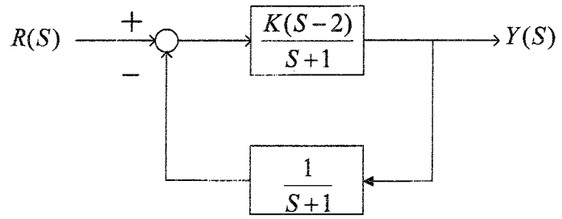
(1)Sketch the root locus. (20%)

(2)Determine the range of K for which the system is stable. (5%)

(3)Determine the range of K such that the steady state error $e(t)$ is less than 0.1 with a ramp input $r(t) = t$, $t \geq 0$. (5%)

(4)Find the steady state error $e(t)$ for an unit-step input $r(t) = 1$, $t \geq 0$. (5%)

3. Plot the Nyquist Plot and determine the range of "K" for stability. (20%)



4. Find the controller value of $u = -\begin{bmatrix} k_1 & k_2 & k_3 \end{bmatrix} x$ such that the closed-loop eigenvalues are $-2 \pm 2j$, and -3. (15%)

$$\dot{x} = \begin{bmatrix} 0 & 1 & -2 \\ 1 & 5 & 2 \\ 0 & 1 & -1 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

5. Consider the following system

$$\dot{x} = \begin{bmatrix} 2 & 1 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \\ 1 \\ 1 \end{bmatrix} u$$

(1)Is it possible to find a gain vector $\boldsymbol{K}$ such that $\boldsymbol{u=Kx+r}$ has $-2, -2, -1, -1$? (5%)

(2)How about $-2, -2, -2, -1$? (5%)

$-2, -2, -2, -2$? (5%)