國立中正大學
114學年度碩士班招生考試
試 題

[第3節]

科目名稱	控制系統
系所組別	電機工程學系-電力與電能處理甲組

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始40分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

國立中正大學 114 學年度碩士班招生考試試題

科目名稱：控制系統　　本科目共 1 頁　第 1 頁

系所組別：電機工程學系-電力與電能處理甲組

1. (20%) The forward-path transfer function of a unity feedback control system is

$$G(s)=\frac{K}{(s-1)(s^2+4s+7)}$$

(a) (10%) Sketch the root loci of the control system and determine the range of K for stability.

(b) (10%) Check the answer in part (a) with the Routh-Hurwitz criterion.

2. (20%) The forward-path transfer function of a unity feedback control system is

$$G(s)=\frac{K}{s(s+6.54)}$$

(a) (10%) Find the value of K and the peak time of the unit-step input for the damping ratio of the closed-loop system being equal to 0.327.

(b) (10%) Determine the resonance peak M_r and resonance frequency w_r of the closed-loop system according to the result of part (a).

3. (30%) The forward-path transfer function of a unity feedback control system with a PD (proportional-derivative) controller is

$$G(s)=\frac{10(K_P+K_Ds)}{s^2}$$

(a) (10%) Select the value of K_P so that the parabolic-error constant is 100.

(b) (10%) Determine the range of K_D for stability by the Nyquist criterion according to the result of part (a).

(c) (10%) Find the value of K_D so that the phase margin of the system is 45° according to the result of part (a).

4. (30%) Consider the following dynamic equation of a system:

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

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

(a) (10%) Determine the stability of the system. Check for the BIBO stability and asymptotic stability, respectively.

(b) (10%) Determine the controllability and observability of the system.

(c) (10%) Assume that the initial state vector is a zero vector. Find the output $y(t)$ when the input is $u(t)=1$ for $t\geq 0$.