

# 國立臺北科技大學

九十二年學年度電機工程系博士班入學考試

## 控制系統（電機乙組）試題

填准考證號碼

第一頁 共一頁

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### 注意事項：

1. 本試題共【五】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. Explain the following terminologies.

- (a) Nyquist stability criterion (5%)      (b) Stabilizable/detectable (5%)  
(c) Principle of optimality (5%)      (d) Lyapunov stability (5%)

2. For the observable dynamic system

$$\begin{aligned}\dot{x}(t) &= Ax(t) + Bu(t) \\ y(t) &= Cx(t) + Du(t)\end{aligned}$$

prove that the observer design does not affect the observability. (20%)

3. Show that for the system  $\frac{Y(s)}{U(s)} = \frac{b_0s^3 + b_1s^2 + b_2s + b_3}{s^3 + a_1s^2 + a_2s + a_3}$  the dynamic equation can be given

by  $\begin{aligned}\dot{x}(t) &= Ax(t) + Bu(t) \\ y(t) &= Cx(t) + Du(t)\end{aligned}$ , where  $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -a_3 & -a_2 & -a_1 \end{bmatrix}$ ,  $B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$ ,

$C = [b_3 - a_3b_0 \quad b_2 - a_2b_0 \quad b_1 - a_1b_0]$ , and  $D = b_0$ . (20%)

4. Show that the transmission zeros are invariant under state feedback. (20%)

5. Consider the Van der Pol oscillator described by

$$\dot{x}_1 = x_2$$

$$\dot{x}_2 = \mu(1 - x_1^2)x_2 - x_1$$

(a) Find the equilibrium point. (10%)

(b) Find the linearized system around the equilibrium point 0. (10%)