

國立臺北科技大學

一百學年第二學期電機系博士班資格考試

控制系統(大學部) 試題

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注意事項：

1. 本試題共【5】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間：二小時。

1. (20%) Please describe the primary objectives of control systems analysis and design.

2. Explanation of terms:

- (1) (5%) Observability (2) (5%) detectability
(3) (5%) controllability (4) (5%) asymptotical stability

3. (1) (10%) State the Nyquist stability criterion.

(2) (10%) The Nyquist plot of the open-loop plant $G(s)$ of a unity negative feedback system is shown below. Suppose that $G(s)$ has two poles in the right-half s -plane and the closed loop system is stable. Is $(-1, j0)$ point at A or B ? Justify your answer.

4. (20%) Given the plant $G(s) = \frac{20(s+5)}{s(s+1)(s+4)}$, design the state feedback gains to

yield closed-loop eigenvalues of -5 and $-3 \pm j4$.

5. (20%) Design the observer gains for the following system such that the closed-loop observer poles are located at -3, -4 and -5.

$$\dot{\mathbf{x}}(t) = \begin{bmatrix} 0 & 0 & -3 \\ 1 & 0 & -3 \\ 0 & 1 & 1 \end{bmatrix} \mathbf{x}(t) + \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} u(t)$$
$$y(t) = [0 \quad 0 \quad 1] \mathbf{x}(t)$$

