

國立臺北科技大學

103 學年第一學期電機系博士班資格考試

現代控制理論 試題

第一頁 共二頁

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注意事項：

1. 本試題共 3 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。
5. 可用計算機。

1. Consider the state space equation of the system

$$\dot{\mathbf{x}} = \begin{bmatrix} -1 & 10 \\ 0 & 1 \end{bmatrix} \mathbf{x} + \begin{bmatrix} -2 \\ 0 \end{bmatrix} \mathbf{u}$$
$$y = [-2 \quad 3] \mathbf{x} - 2\mathbf{u}$$

15% (a) Is it BIBO stable? Please justify your answer.

15% (b) Is it marginally stable? Please justify your answer.

15% (c) Is it asymptotically stable? Please justify your answer.

2. Consider the state space equation of the system

$$\dot{\mathbf{x}} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -3 & -3 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} \mathbf{u}$$
$$y = [1 \quad 2 \quad 1] \mathbf{x}$$

15% (a) Is it controllable? Please justify your answer.

15% (b) Is it observable? Please justify your answer.

3. Consider the state space equation of the system

$$\dot{\mathbf{x}} = \begin{bmatrix} 2 & 1 \\ -1 & 1 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 1 \\ 2 \end{bmatrix} \mathbf{u} .$$
$$y = [1 \quad 1] \mathbf{x}$$

Find the state feedback gain \mathbf{k} so that the state feedback system has -1 and -2 as its eigenvalues.

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