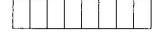
國立臺北科技大學

九十六學年第一學期電機系博士班資格考試

現代控制理論試題

填學生證號碼



注意事項:

- 本試題共【7】題,配分共140分,70分及格。
 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。
- 考試時間:二小時。
- 1. Given a matrix $A = \begin{bmatrix} 0 & 0 & -2 \\ 0 & 1 & 0 \\ 1 & 5 & 3 \end{bmatrix}$, find e^{At} by (a) Caley Hamilton theorem (b) Laplace

Transform. (20%)

- 2. Show that if λ is an eigenvalue of A with eigenvector x, then $f(\lambda)$ is an eigenvalue of f(A)with the same eigenvector x. (20%)
- 3. Given a transfer function matrix

$$G(s) = \begin{bmatrix} \frac{5s-10}{3s+1} & \frac{-6}{s+4} \\ \frac{3}{(3s+1)(s+3)} & \frac{2s+7}{(s+4)^2} \end{bmatrix}, \text{ find the realization by column.}$$
 (20%)

4. Given a linear time invariant system (A, B, C, D), show that the transformed system $(A, \overline{B}, C, \overline{D})$ obtained by the equivalence transformation from (A, B, C, D) with the nonsingular equivalence transformation matrix P has (a) the same eigenvalues as (A, B, C, D) (b) the same transformation matrix as (A, B, C, D).

- 5. Show that the pair (**A**, **C**) is observable if and only if $W_o(t) = \int_0^t e^{A^T t} C^T C e^{A t} d\tau$ is nonsingular for any t > 0. (20%)
- 6. Reduce the state equation

to a controllable and observable state equation. Please explain your answer. (20%)

7. Given a single-input single-output system (A, B, C, D) show that the system is a minimal realization if (A, B) is controllable and (A, C) is observable. (20%)