所別：電機工程學系碩士班 丙組(一般生) 科目：控制系統

1. Find the steady state output of the system described by the state model:

$$\begin{bmatrix}\dot{x}_1(t)\\ \dot{x}_2(t)\end{bmatrix}=\begin{bmatrix}-1 & 2\\ 0 & -3\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}+\begin{bmatrix}1 & 0\\ 0 & 4\end{bmatrix}\begin{bmatrix}u_1(t)\\ u_2(t)\end{bmatrix}$$

$$\begin{bmatrix}y_1(t)\\ y_2(t)\end{bmatrix}=\begin{bmatrix}1 & 1\\ 1 & -1\end{bmatrix}\begin{bmatrix}x_1(t)\\ x_2(t)\end{bmatrix}$$

with the input and the initial condition given, respectively, by

$$\begin{bmatrix}u_1(t)\\ u_2(t)\end{bmatrix}=\begin{bmatrix}5 & 0\\ 0 & 2\end{bmatrix}\begin{bmatrix}\delta(t)\\ 1(t)\end{bmatrix} \text{ and } \begin{bmatrix}x_1(0)\\ x_2(0)\end{bmatrix}=\begin{bmatrix}10\\ 20\end{bmatrix}$$

where $\delta(t)$ is the Dirac delta (impulse) function and $1(t)$ is the unit step function. **(20%)**

2. Consider a plant:

$$\dot{x}(t)=\begin{bmatrix}0 & 1 & 0 & 0\\ 0 & 0 & 1 & 0\\ 0 & 0 & 0 & 1\\ -2 & -1 & 2 & 1\end{bmatrix}x(t)+\begin{bmatrix}0\\ 0\\ 0\\ 1\end{bmatrix}u(t)$$

$$y(t)=\begin{bmatrix}-2 & -1 & 2 & 1\end{bmatrix}x(t)$$

Suppose that the state feedback $u(t) = -[\ 0\ \ 2\ \ 3\ \ 4]\ x(t)$ is used.

(1) Is the closed-loop system stable? **(20%)**

(2) Find the zeros of the closed-loop system. **(10%)**

注意：背面有試題

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3. (1) Discuss if the polynomial

$P(s)=s^7+2s^6+5s^5+7s^4+2s^3-5s^2-8s-4$ is Hurwitz? (10%)

(2) Apply the Routh-Hurwitz criterion to find the number of the polynomial RHP zeros (10%).

(3) Find the jw-axis zeros (10%).

4. In the following Figure, take the state variables to be the voltage across the capacitor C_1, the current through the inductor L_1, and the current through the inductor L_2, The source current i_s is the control variable, and the current through the inductor L_2 is the system output

(1)Derive a state-space model of this circuit (10%).

(2)Discuss the circuit model controllability (5%).

(3)Discuss the circuit model observability (5%).