所別：電機工程學系碩士班 丙組(一般生) 科目：控制系統

I、填充題:

1. A system has the following differential equation: $\dot{\mathbf{x}} = \begin{bmatrix} -1 & 0 \\ 2 & -3 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} r(t)$.

   Determine the state transition matrix = _____. (15%)

2. The block diagram of a machine-tool control system is shown in Fig. 1, and the transfer function $T(s) = Y(s)/R(s)$.

   Determine: (a) The sensitivity S_b^T = _____. (15%)

   (b) Select K = _____ when $1 \le K \le 50$ so that the effects of the disturbance and S_b^T are minimized. (15%)

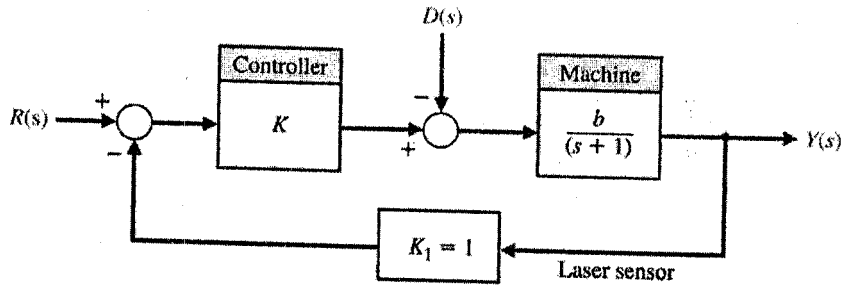

Fig. 1 A Machine-tool control system

3. Consider the system represented in the state variable form $\begin{matrix} \dot{\mathbf{x}} = \mathbf{A}\mathbf{x} + \mathbf{B}u \\ y = \mathbf{C}\mathbf{x} + \mathbf{D}u \end{matrix}$, where

$$\mathbf{A} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -k & -k & -k \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix},$$

$\mathbf{C} = [1 \quad 0 \quad 0]$, $\mathbf{D} = [0]$

For what values of k is the system stable? k = _____. (15%)

注意：背面有試題

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4. A closed-loop system has the loop transfer function $GH(s) = \frac{Ke^{-Ts}}{s}$.
Determine the gain K so that the phase margin is 60° when $T = 0.2$.
$K =$ _____ (15%)

II、設計題:

5. The model for a position control system using a DC motor is shown in Fig. 2. The goal is to select K_1 and K_2 so that the peak time is 0.2 second and the overshoot (P.O.) for a step input is negligible (1% < P.O. < 4%). (25%)(Refer to Fig. 3)

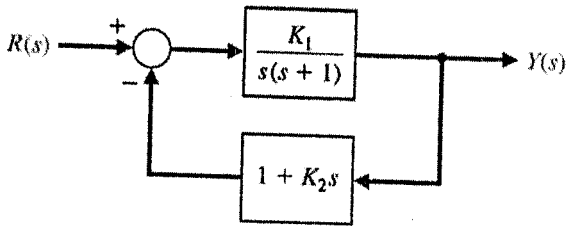

Fig. 2 A position control system

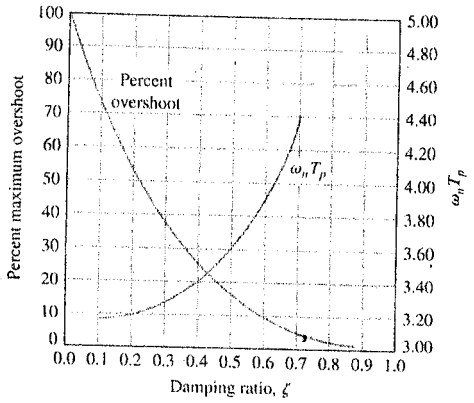

Fig. 3 Percent overshoot and normalized peak time versus damping ratio for a second-order system