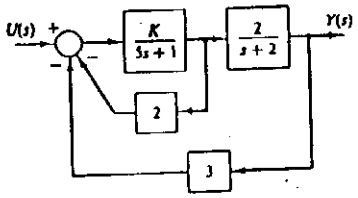
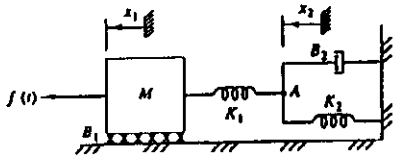
國立臺灣科技大學
八十七學年度碩士班招生考試試題

所　別：纖維及高分子工程技術研究所　組別：控制組　　科目：控制系統
學程別：

1. (a) Find the closed-loop transfer function T(s)=Y(s)/U(s). (5%)
(b) Determine the undamped natural frequency ω_n and the damping ratio ζ of the closed-loop system. Solve for the value of K for which $\omega_n = 5$ rad/s, and find the corresponding value of ζ. (10%)
(c) Find the steady-state value of the response when the input is a step function of height 5 and when K has the value determined in part (b). (5%)



2. The system input is the force, f(t), and the output is the displacement x_2 of the massless junction A as shown.
(a) Find the state equation and output equation. (10%)
(b) Repeat the problem when the dashpot B_2 is removed. (10%)



3. Consider the system defined by

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-1 & 1\\ 0 & 2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}1\\ 0\end{bmatrix}u$$

Show that the system cannot be stabilized by the state feedback control scheme

$u = -K\begin{bmatrix}x_1\\ x_2\end{bmatrix}$ whatever matrix K is chosen. (10%)

背面2頁

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4. Consider the system shown in Fig. (a), where $G(s) = \dfrac{K}{(s+3)(s+6)}$

(A) Sketch the root locus for the system (5%)
(B) Find the value of K to let damping ratio $\zeta = 0.707$ (5%)
(C) Determine the *%OS, Ts, Kp* for an step input. (10%)
(D) Design an idea controller to drive the step response error to zero (5%)

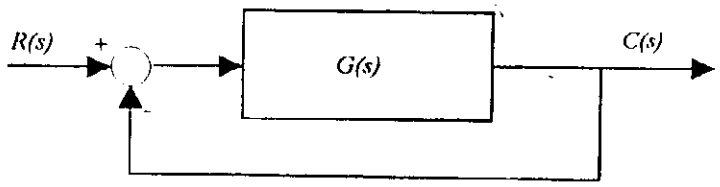

Figure (a)

5. Given the unity feedback system of Fig. (a), where $G(s) = \dfrac{K}{s(s+5)(s+7)}$

(A) Draw the Bode plots of the system (10%)
(B) Use Bode plots to determine the range of K within which the system is stable (5%)
(C) Use frequency response methods to determine the value of gain, K, to yield a step response with a 20% overshoot. (10%)