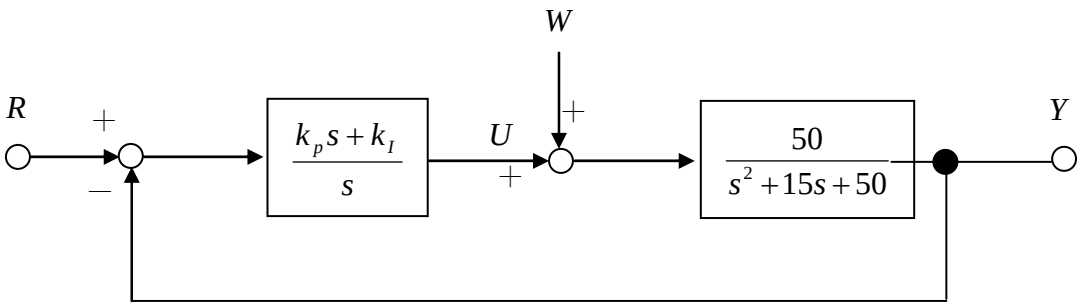
# 國立彰化師範大學 98 學年度碩士班招生考試試題

系所：機電工程學系　　組別： 甲 組　　科目：(甲)自動控制

☆☆請在答案紙上作答☆☆　　

1.(1) Derive the differential equation relating the input R(s) and W (s) to the output Y(s) for the system described as follows with the proportional controller gain $k_p$, and integral controller gain $k_I$. (5%)




(2) When $k_I$ = W=0, what's the definition of transient response? Write the transient response of this closed loop system in general form with different $k_p$. (12%)

(3) When $k_I$ = W= 0, find the value of $k_p$, such that the damping ratio of the closed-loop system is 0.707 (3%)

(4) With the result of (2), find the steady state error, when the input is a unit step. (5%)

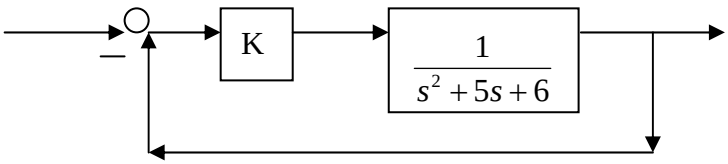
2. Find the unit step response of this transfer function if the initial conditions are zero. Write the result as a function of time. (10%)

$$\frac{\theta_o(s)}{\theta_i(s)} = \frac{3}{s(s^2+1)}$$

3. Find the range of the K by this transfer function if

(1) the steady state error is less than 5% for constant command 1. (10%)

(2) for all solutions of homogeneous equation to decay at least as fast as $e^{-t}$. (5%)



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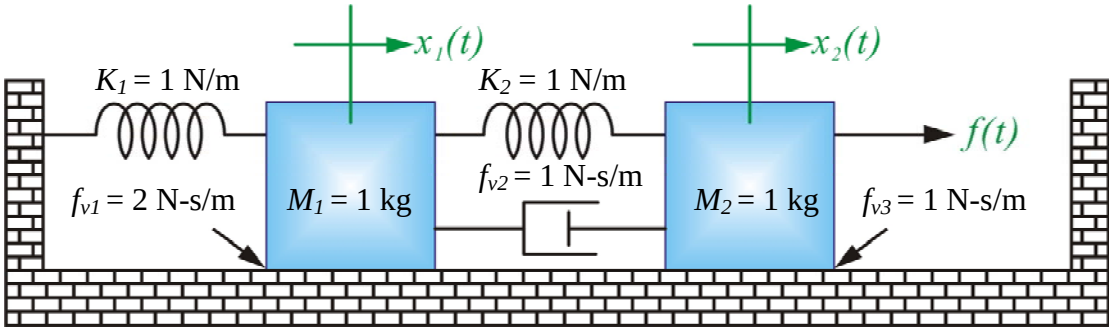
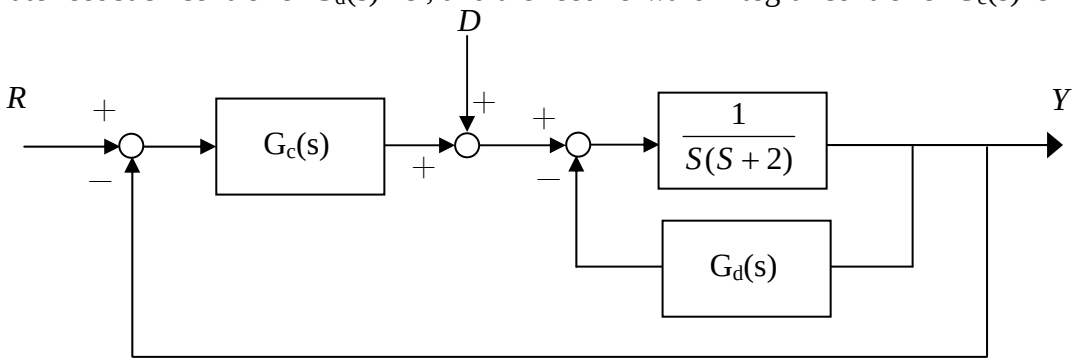
4. Convert the following state-space standard form into transfer function as the input-output function of C(s)/R(s). (10%)

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -24 & -26 & -9 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} r \qquad c = \begin{bmatrix} 2 & 7 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + o \times r$$

5. Write the transfer function:　G1(s)=x1(s)/F(s) and G2(s)=x2(s)/F(s),
where $f_v$ indicates the viscous damper, $K$ is the spring, $f(t)$ is the applied force. (14%)




6. Find the value of K when the steady state error caused by the unit ramp disturbance is 0.1
If the rate feedback controller $G_d(s)= s$ , and the feed forward integral controller $G_c(s)$ is K/s. (10%)




7. Sketch the Bode plot for asymptotic magnitude plot (12 %) and phase plot. (4%)

$$\frac{1}{(S+10)(S^2+S+4)}$$