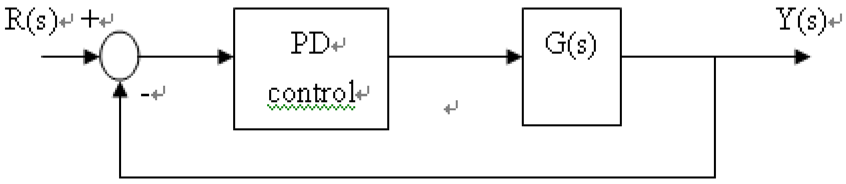
國立屏東科技大學 九十六 學年度碩士班暨碩士在職專班招生考試

自動控制

1. The block diagram of a PD control system is shown below



where $G(s)=\dfrac{2}{s^2+1}$ and the transfer function of the PD controller is $G_c=K_P+K_D s$

(a) Find K_p and K_D on which the damping is critical and the natural undamped frequency ω_n is 5 rad/sec.

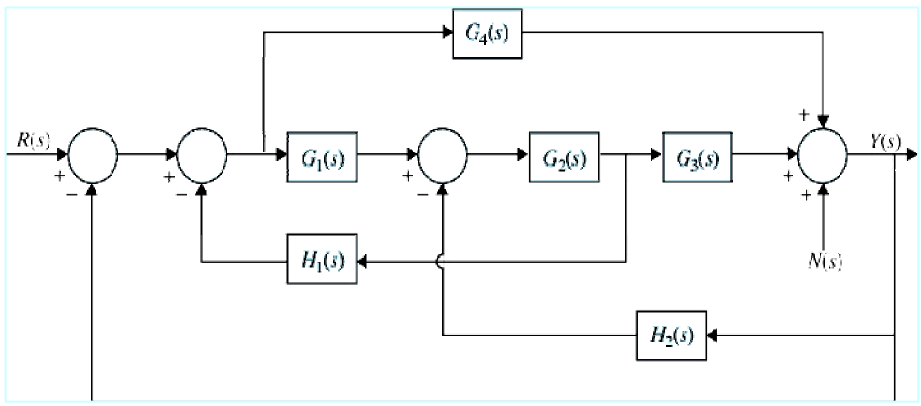
(b) From part (a), with unity-step input, find the steady-state error.

(c) From part (a), with unity-step input, find the steady-state value of y(t).

(d) Find the parabolic-error constant K_a.

(20 points)

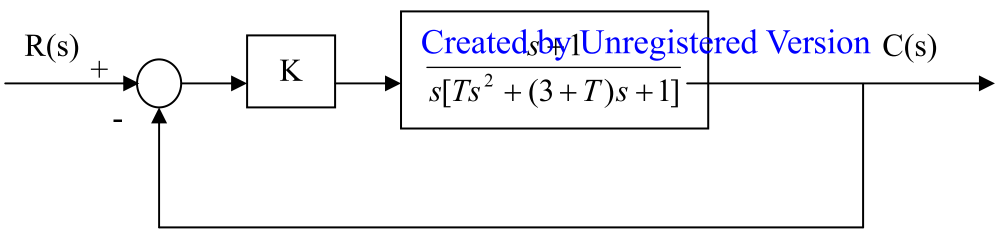
2. For a system block diagram shown below



Please find the transfer function $\dfrac{Y(s)}{R(s)}$=?

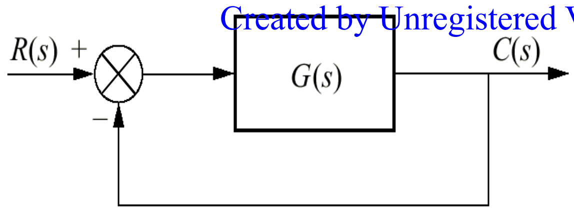
(15 points)

3. Please find the range of K and T for the stability of the closed-loop system ?



(15 points)

4. Consider a unity feedback system with open-loop delay transfer function as shown in the following figure, where $G(s)=\dfrac{3e^{-sT}}{s(s+2\sqrt{2})}$. What is the maximum time delay T without destroying the closed-loop stability?



(15points)

5. A control system is represented by the following state equations:

$$\dot{x}_1 = 3x_1 - 8x_2$$
$$\dot{x}_2 = 4x_1 + u$$

The control law is designed as the following state feedback form

$$u = -ax_1 - bx_2$$

where a and b are real constants. Determine and sketch the region of a and b for the overall system to be stable. Please put a as the x-axis and b as the y-axis.
(20 points)

6. For a dynamic system with state equations:

$$\dot{x}_1 = -x_2 + u$$
$$\dot{x}_2 = -3x_1 + 2x_2 - 3u$$
$$y = x_1$$

(a) Determine the controllability and observability of the system.

(b) Find the transfer function $\dfrac{\mathrm{Y}(s)}{\mathrm{U(s)}}$

(c) Is it possible to use output feedback control $u = -ky$ for arbitrary pole assignment?

(15 points)