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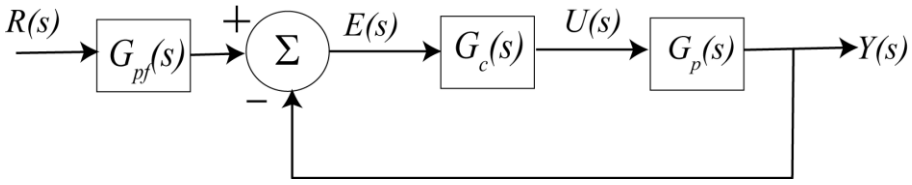
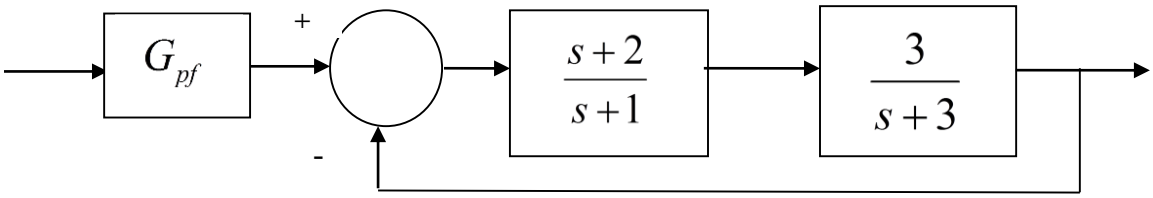
Quiz #8

For the following problems, the closed loop transfer function for the following feedback system is

$$\frac{Y(s)}{R(s)} = G_o(s) = \frac{G_{pf}(s)G_c(s)G_p(s)}{1+G_c(s)G_p(s)}$$



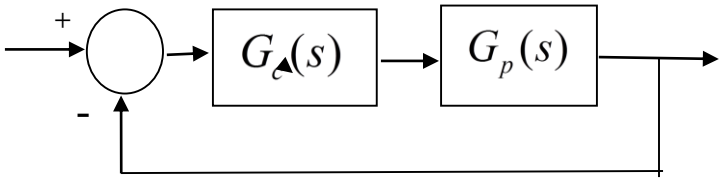
1) For the following system:



the value of the prefilter G_{pf} that produces **a steady state error** of zero for a unit step input is:

a) 1 b) 3/2 c) 5/2 d) 1/3

2) For the following system



the pole of the controller $G_c(s)$ is at -15
the poles of the plant $G_p(s)$ are at -1 and -2
the poles of the closed loop system are at -7.1, -5.43 +3.98j, -5.43 -3.98j

The best estimate of the settling time of the closed loop system is

a) 4 seconds b) $\frac{4}{15}$ seconds c) $\frac{4}{7.1}$ seconds d) $\frac{4}{5.43}$ seconds

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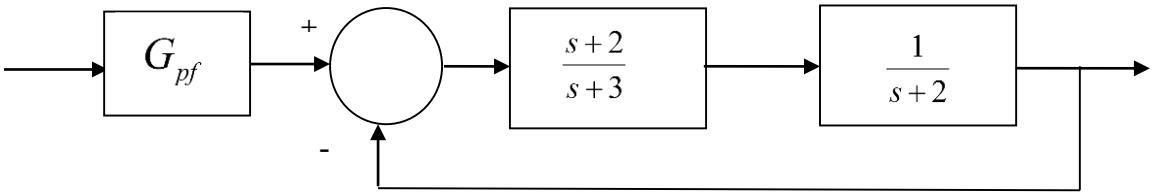
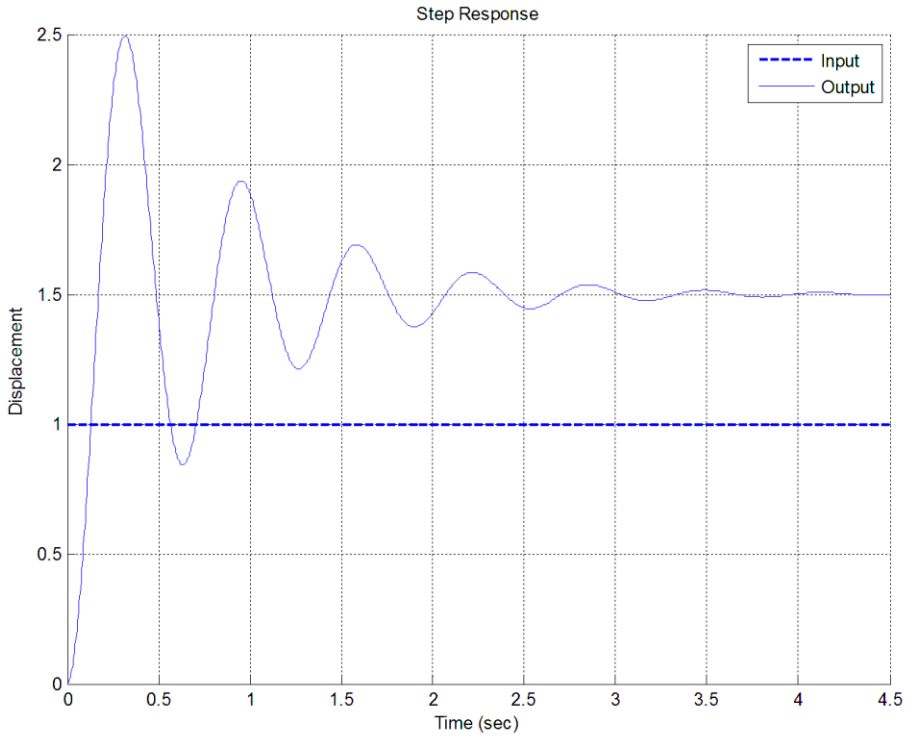
3) For the following system:



the value of the prefilter G_{pf} that produces **a steady state error** of zero for a unit step input is:

a) 1 b) 3/2 c) 4 d) 1/3

Problems 4 and 5 refer to the **unit step response** of a system, shown below



4) The best estimate of the **steady state error** for a **unit step input** is

a) 0.5 b) -0.5 c) 1.5 d) -1.5 e) none of these

5) The best estimate of the **percent overshoot** is

a) 200% b) 100% c) 67% d) 50% e) none of these

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6) The **unit step response** of a system is given by $y(t) = -u(t) - t^4 e^{-t} u(t) + e^{-2t} u(t)$

The **steady state error** for a unit step input for this system is best estimated as

a) ∞ b) 0.5 c) 2.0 d) impossible to determine

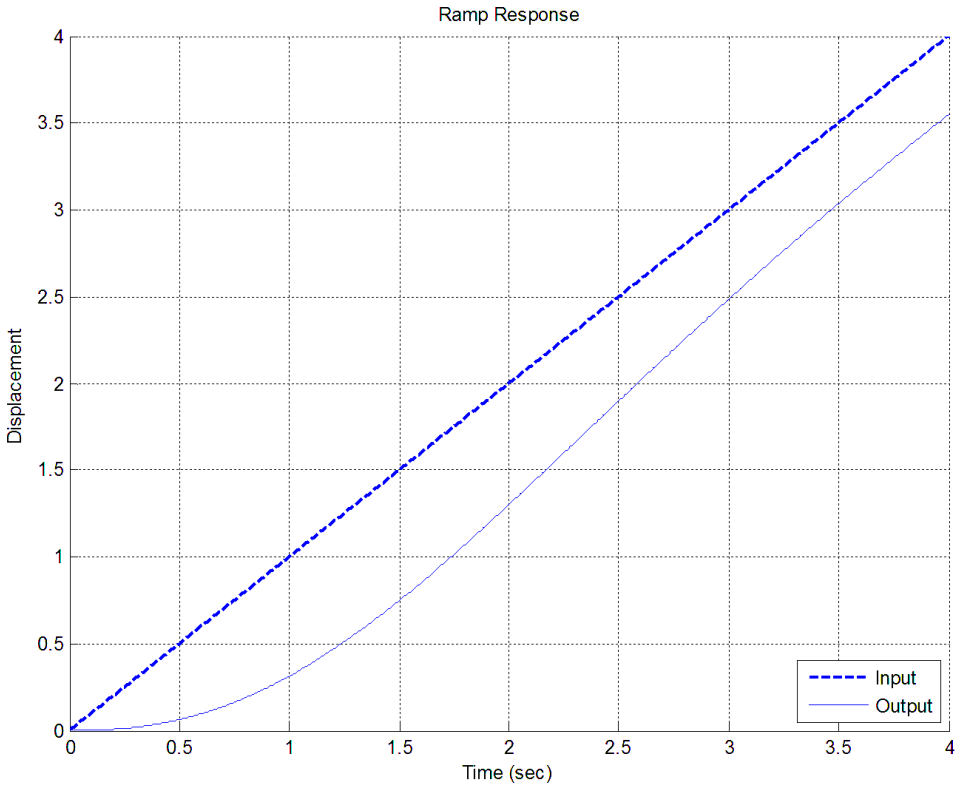
7) The **unit ramp response** of a system is given by $y(t) = -2u(t) + tu(t) + e^{-t} u(t)$.

The best estimate of the **steady state error** is

a) 0.5 b) 2.0 c) 1.0 d) ∞

8) For a system with unit ramp response shown below, **t**he best estimate of the **steady state error** is

a) 0.5 b) -0.5 c) 0.8 d) -0.8 e) 0.0 f) none of these



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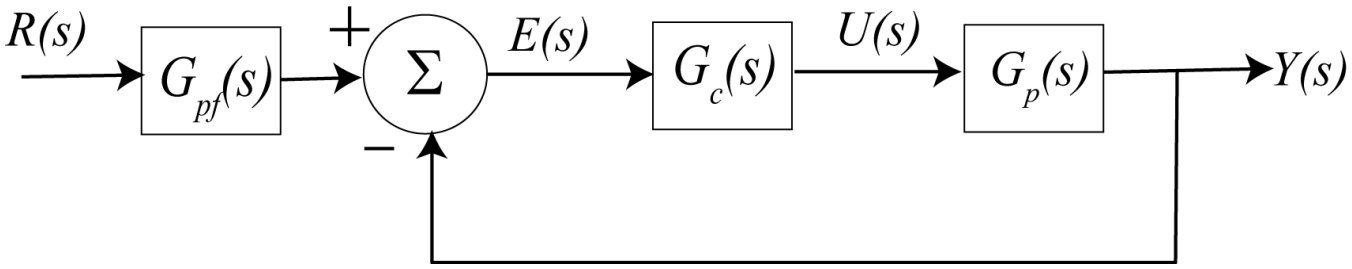
Problems **9-12** refer to the following feedback system, with the plant $G_p(s) = \frac{4}{s+1}$ and proportional controller, $G_c(s) = k_p$



9) What is the (2%) settling time of the plant ?

a) 1 second b) 2 seconds c) 3 seconds d) 4 seconds e) none of these

10) If we want the settling time to be 4/21 seconds, the value of k_p should be

a) 5 b) 10 c) 21 d) 25 e) none of these

11) If we assume the prefilter is 1 ($G_{pf}(s) = 1$), and we want the steady state error for a unit step to be 1/25, then we should choose the value of k_p to be

a) 3 b) 4 c) 5 d) 6 e) none of these

12) Does a constant prefilter affect the settling time? a) yes b) no

Problems 13 -15 refer to a plant with transfer function $G_p(s) = \frac{5}{(s+1)(s+4)}$

13) The (2%) settling time for this plant is

a) 1 seconds b) 2 seconds c) 3 seconds d) 4 seconds e) none of these

14) If the input to the plant is a unit step, the steady state error will be

a) 0 b) 0.25 c) -0.25 d) 3/8 e) 1.0 f) none of these

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15) The static gain of the plant is a) 1 b) 1.25 c) 5 d) none of these

Problems 16 and 17 refer to the impulse responses of six different systems given below:

$$h_1(t) = [t + e^{-t}]u(t)$$
$$h_2(t) = e^{-2t}u(t)$$
$$h_3(t) = [2 + \sin(t)]u(t)$$
$$h_4(t) = [1 - t^3 e^{-0.1t}]u(t)$$
$$h_5(t) = [1 + t + e^{-t}]u(t)$$
$$h_6(t) = [te^{-t}\cos(5t) + e^{-2t}\sin(3t)]u(t)$$

16) The number of **stable systems** is a) 0 b) 1 c) 2 d) 3

17) The number of **unstable systems** is a) 0 b) 1 c) 2 d) 3

18) Which of the following transfer functions represents a **stable** system?

$$G_a(s) = \frac{s-1}{s+1} \qquad G_b(s) = \frac{1}{s(s+1)} \qquad G_c(s) = \frac{s}{s^2-1}$$
$$G_d(s) = \frac{s+1}{(s+1+j)(s+1-j)} \qquad G_e(s) = \frac{(s-1-j)(s-1+j)}{s} \qquad G_f(s) = \frac{(s-1-j)(s-1+j)}{(s+1-j)(s+1+j)}$$

a) all but G_c b) only G_a, G_b, and G_d c) only G_a, G_d, and G_f
d) only G_d and G_f e) only G_a and G_d

Problems 19 and 20 refer to a system with poles at -2+j. -2-j. -4, -1+2j, -1-2j, and -20

19) The best estimate of the **settling time** for this system is

a) 4 seconds b) 2 seconds c) 1 second d) 0.2 seconds

20) The **dominant pole(s)** of this system are

a) -2+j and -2-j b) -1+2j and -1-2j c) -4 d) -20