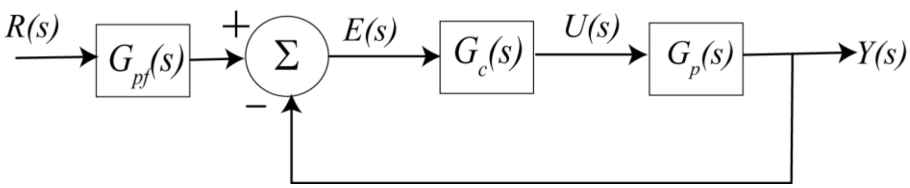
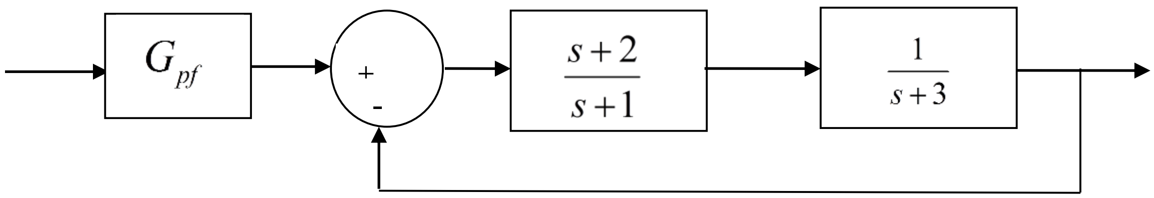
ECE-205 Practice Quiz 6

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) The **unit step response** of a system is given by $y(t) = 0.5u(t) - tu(t) - t^4e^{-t}u(t) + e^{-t}u(t)$

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

3) The **unit step response** of a system is given by $y(t) = 0.5u(t) - t^4e^{-t}u(t) + e^{-t}u(t)$

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

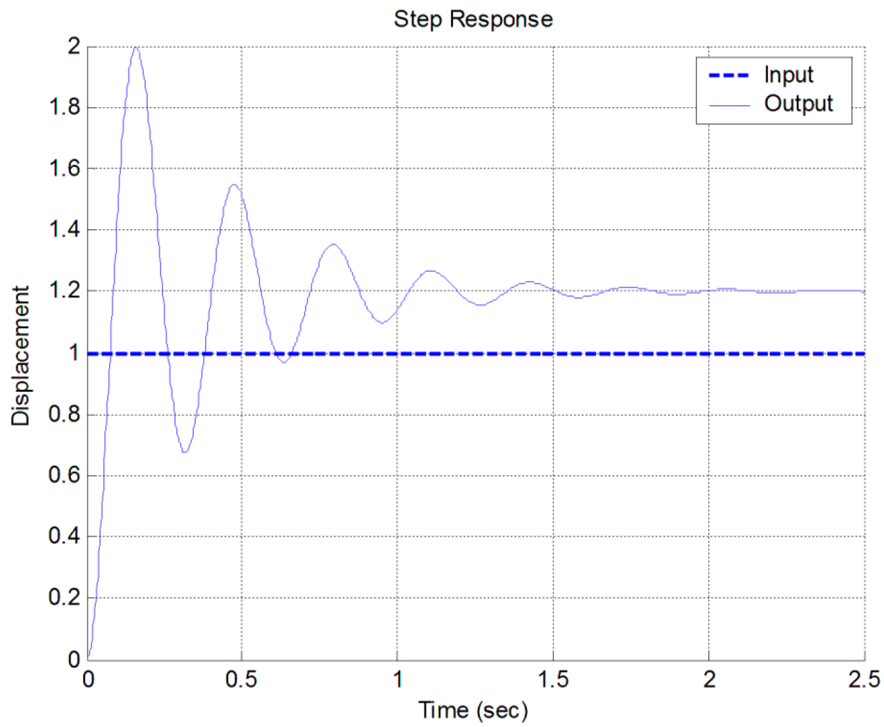
a) ∞ b) 0.5 c) 2.0 d) impossible to determine

4) The **unit step response** of a system is given by $y(t) = 1.5u(t) - te^{-t}u(t) + e^{-t}u(t)$

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

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

Problems 5-6 refer to the **unit step response** of a system, shown below



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

a) 0.20 b) -0.20 c) 1.0 d) -0.0

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

a) 200% b) 100% c) 67% d) 20%

7) For the system described by the following transfer function

$$G(s) = \frac{bs + a}{(s+1)(s+6)}$$

For a zero **steady state error** for a step input, the value of *a* should be

a) 0 b) 6 c) 1 d) 5

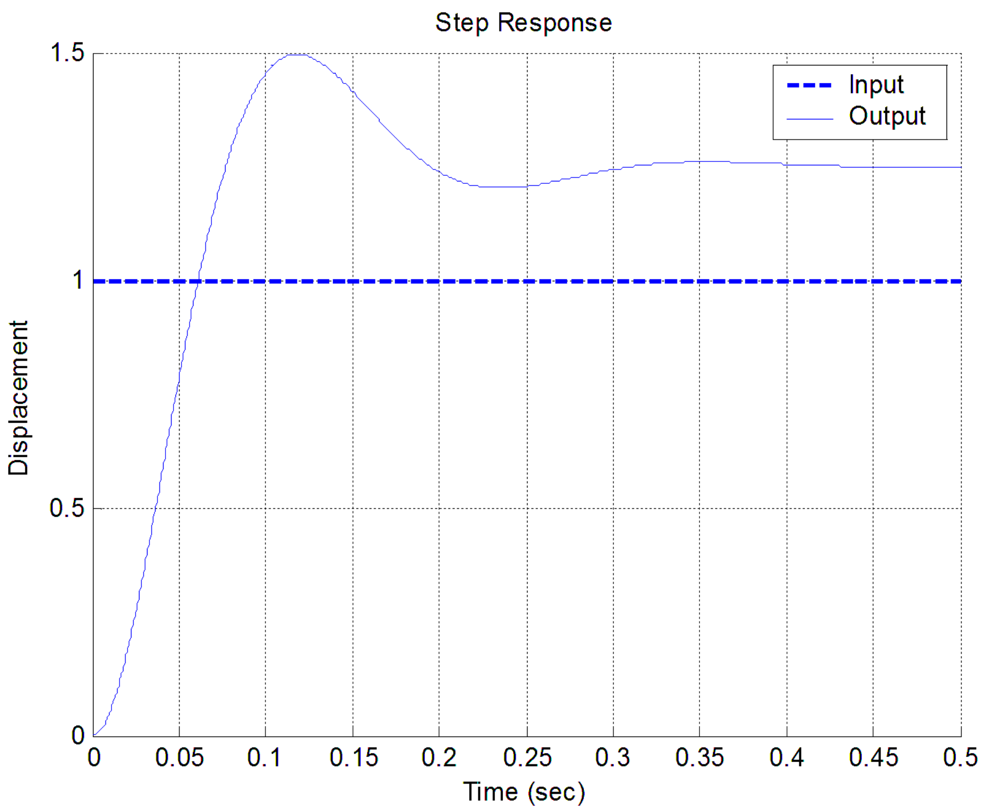
Problems 8 and 9 refer to the system described by the transfer function $G(s) = \frac{s+1}{(s+2)(s+3)}$

8) The ***steady state error*** for **a unit step input** for this system is best approximated as

a) 1/6 b) 2 c) 0 d) 5/6

9) The **static gain** for this system is a) 1/3 b) 1/2 c) 1/6 d) none of these

Problems 10 and 11 refer to the **unit step response** of a system, shown below



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

a) 0.50 b) 0.25 c) -0.25 d) 0.0 e) impossible to determine

11) The best estimate of the **percent overshoot** is a) 20% b) 50% c) 25% d) 150%

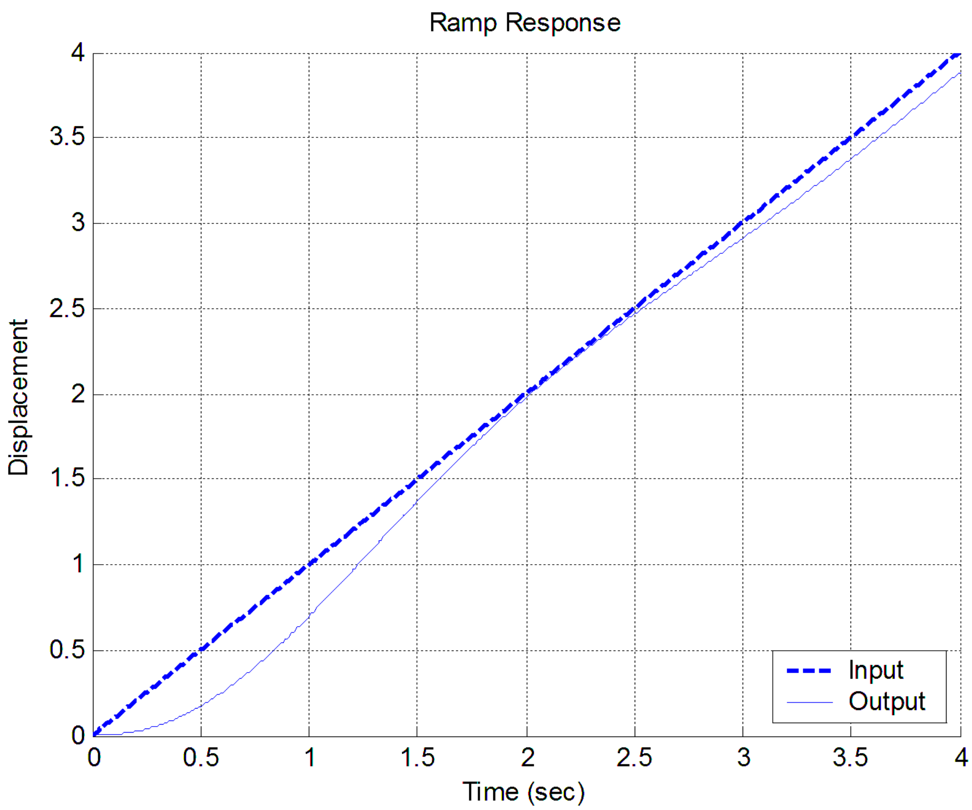
12) The **unit ramp response** of a system is given b $y(t) = -0.5u(t) - 2tu(t) + e^{-t}u(t)$.

The best estimate of the **steady state error** for a **unit ramp input** is

a) 0.5 b) 2.0 c) 1.0 d) ∞

13) For the **unit ramp response** of a system, shown below, the best estimate of the **steady state error** is

a) 0.1 b) -0.1 c) 0 d) 0.4 e) -0.4

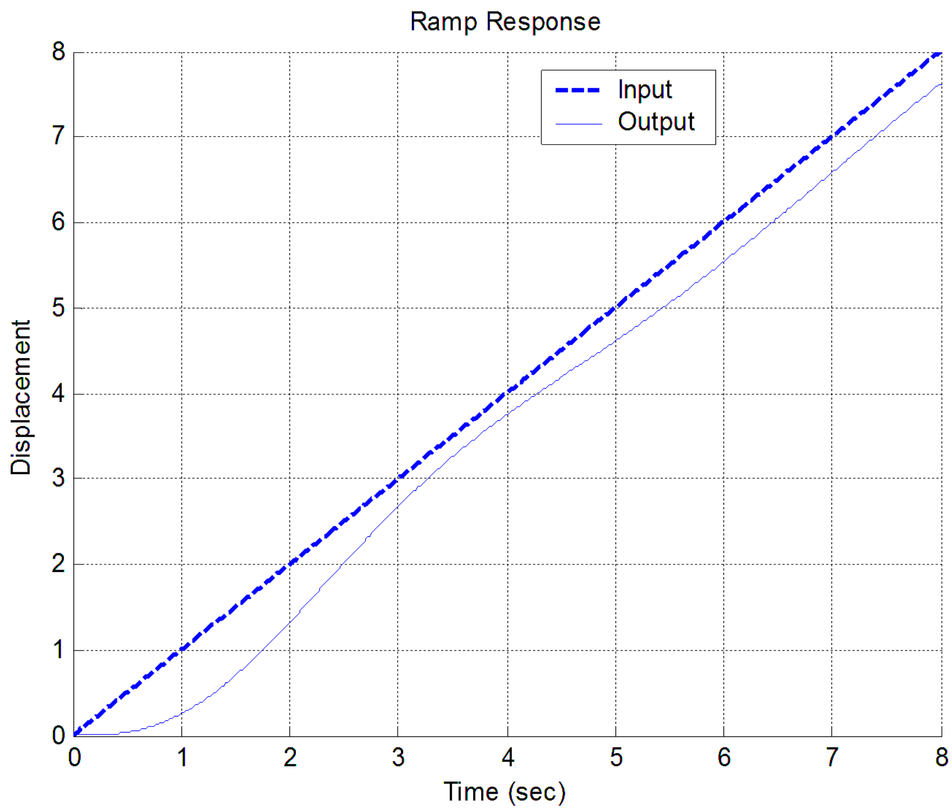


14) The **unit ramp response** of a system is given by $y(t) = -0.5u(t) + tu(t) + e^{-t}u(t)$.

The best estimate of the **steady state error** is a) 0.5 b) 2.0 c) 1.0 d) ∞

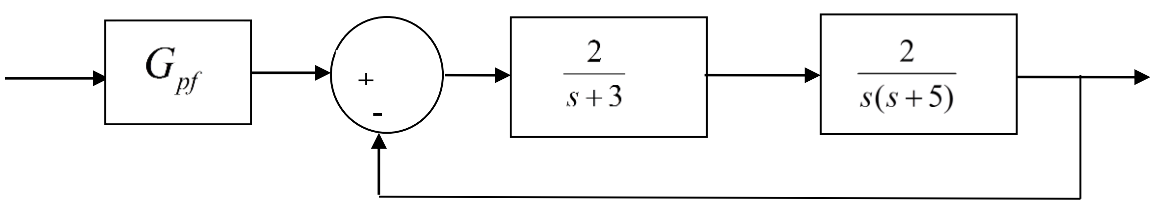
15) For the **unit ramp response** of a system shown below, the best estimate of the **steady state error** is

a) 0.8 b) 0.6 c) 0.4 d) 0.2



16) For the block diagram below, the value of the prefilter G_{pf} that produces zero **steady state error** for a unit step input is:

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



Problems 17 and 18 refer to a plant with transfer function $G_p(s) = \frac{3}{s+4}$

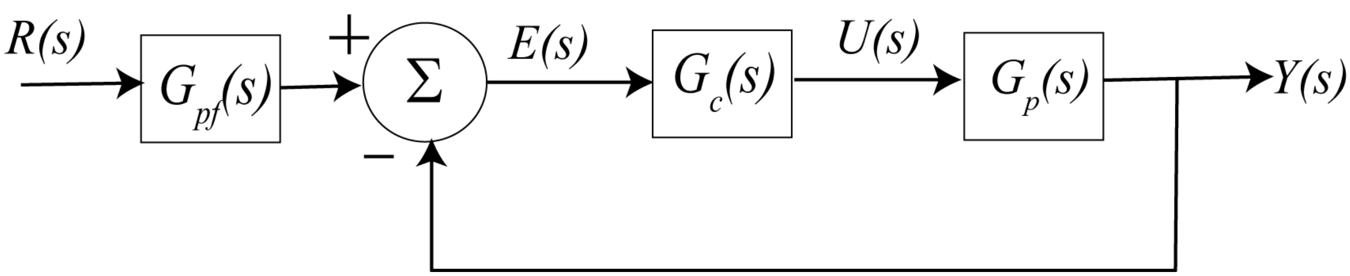
17) The (2%) settling time for this plant is

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

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

a) 0 b) 0.25 c) 0.5 d) 0.75 e) 1.0 f) none of these

Problems **19-21** refer to the following feedback system, with the plant $G_p(s) = \frac{3}{s+4}$ and proportional controller, $G_c(s) = k_p$



19) If we want the settling time to be 0.1 seconds, the value of k_p should be

a) 40 b) 36 c) 12 d) 10 e) none of these

20) If we assume the prefilter is 1 ($G_{pf}(s) = 1$), and we want the steady state error for a unit step to be 4/19, then we should choose the value of k_p to be

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

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

Problems 22 and 23 refer to a plant with transfer function $G_p(s) = \dfrac{5}{(s+4)(s+2)}$

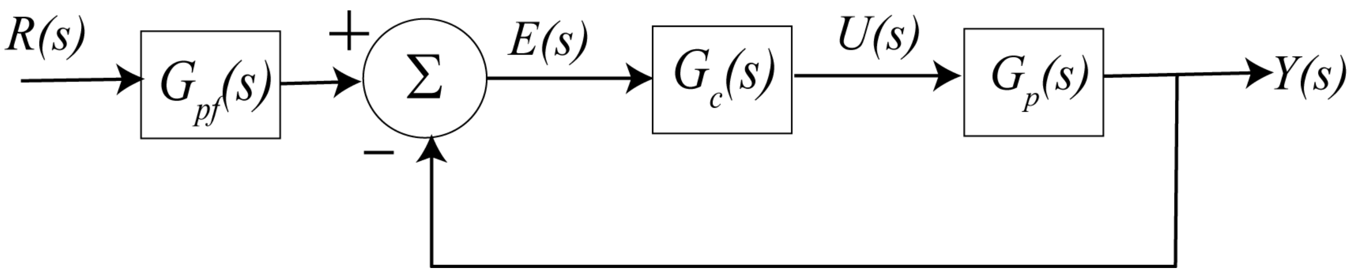
22) The (2%) settling time for this plant is

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

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

a) 0 b) 5/8 c) 0.5 d) 3/8 e) 1.0 f) none of these

Problems **24** refers to the following feedback system, with the plant $G_p(s) = \dfrac{5}{(s+4)(s+2)}$ and proportional controller, $G_c(s) = k_p$



24) If we assume the prefilter is 1 ($G_{pf}(s)=1$), and we want the steady state error for a unit step to be 8/58, then we should choose the value of k_p to be

a) 40 b) 36 c) 12 d) 10 e) none of these

Problems 25 and 26 refer to the impulse responses of six different systems given below:

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

25) The number of (asymptotically) **maginally stable systems** is a) 0 b) 1 c) 2 d) 3

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

27) Which of the following transfer functions represents a (asymptotically) **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 28 and 29 refer to the following impulse responses of six different systems

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

28) The number of (asymptitcally) **unstable** systems is a) 1 b) 2 c) 3 d) 4

29) The number of (asymptotically) **marginally stable** systems is a) 1 b) 2 c) 3 d) 4

Problems 30 and 31 refer to a system with poles at -2+5j. -2-5j. -10+j, -10-j, and -20

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

a) 2 seconds b) 0.4 seconds c) 4/5 seconds d) 0.2 seconds

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

a) -2+5j and -2-5j b) -10+j and -10-j c) -20

32) Which of the following transfer functions represents a (asymptotically) **stable** system?

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

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

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

Answers: 1-c, 2-a, 3-b, 4-c, 5-b, 6-c, 7-b, 8-d, 9-c, 10-c, 11-a, 12-d, 13-a, 14-a, 15-c, 16-a, 17-a, 18-b, 19-c, 20-c, 21-b, 22-b, 23-d, 24-d, 25-d, 26-b, 27-c, 28-b, 29-a, 30-a, 31-a, 32-a