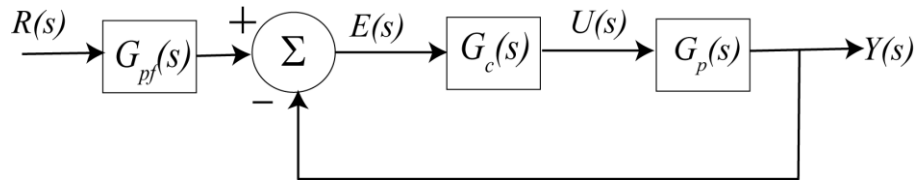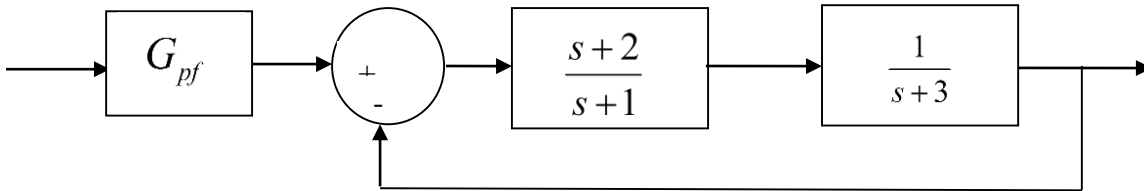# ECE-205 Practice Quiz 8

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

The **<u>steady state error</u>** 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 **<u>unit step response</u>** of a system is given by $y(t) = 0.5u(t) - t^4 e^{-t}u(t) + e^{-t}u(t)$

The **<u>steady state error</u>** 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 **<u>unit step response</u>** of a system is given by $y(t) = 1.5u(t) - te^{-t}u(t) + e^{-t}u(t)$

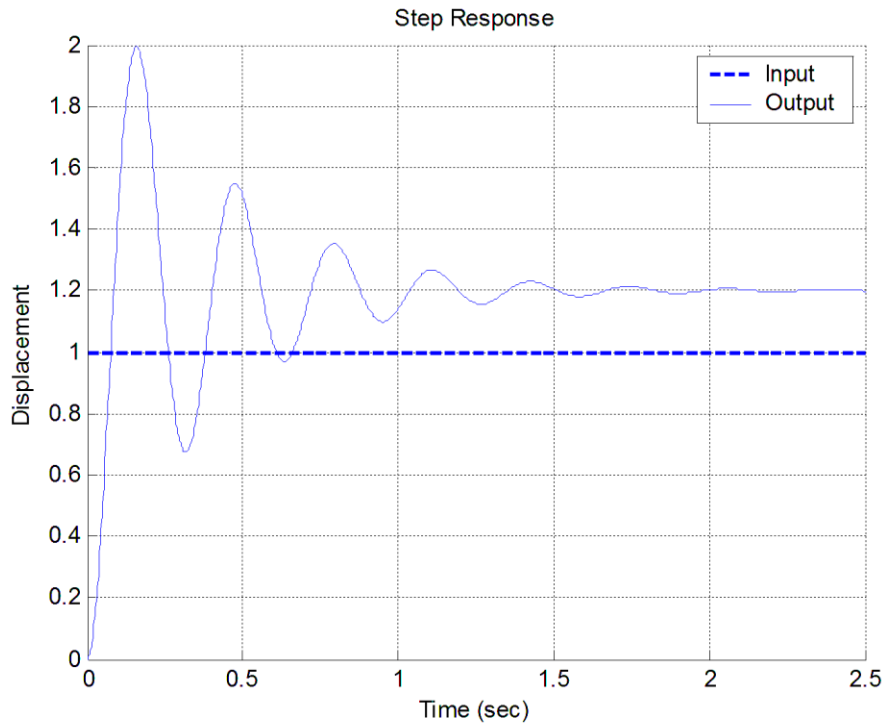The **<u>steady state error</u>** for a unit step input for this system is best estimated as

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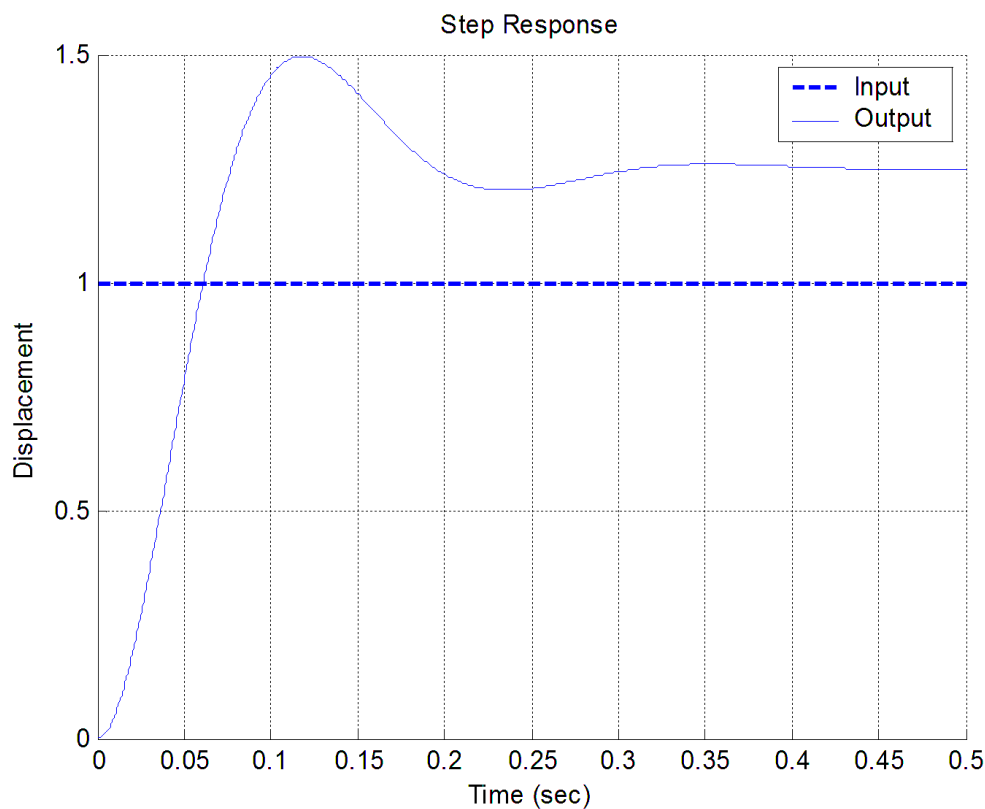
a) 0     b) 6     c) 1     d) 5

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

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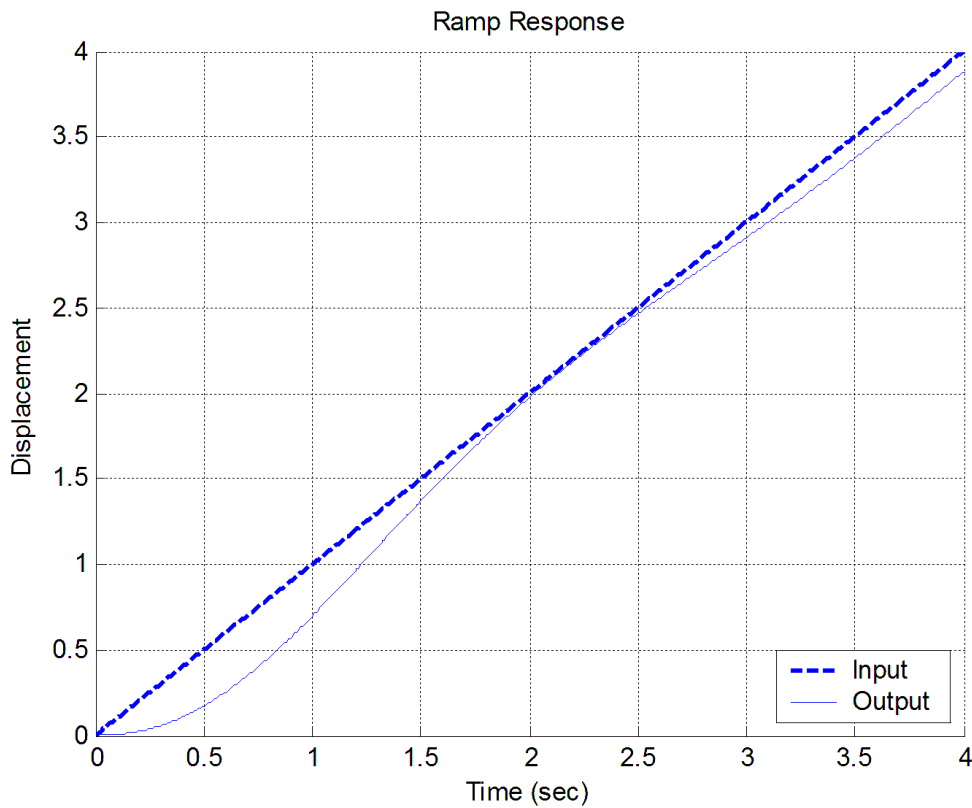
**12)** The **unit ramp response** of a system is given b $y(t) = -0.5u(t) - 2tu(t) + e^{-t}u(t)$.

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

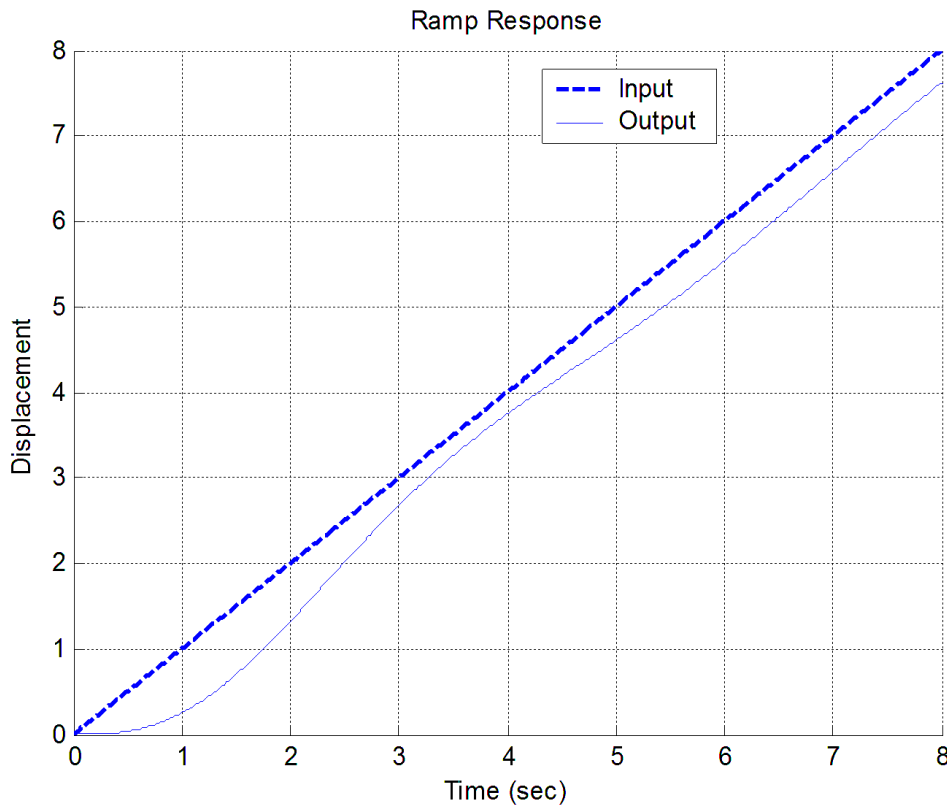a) 0.1  b) -0.1  c) 0  d) 0.4  e) -0.4



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

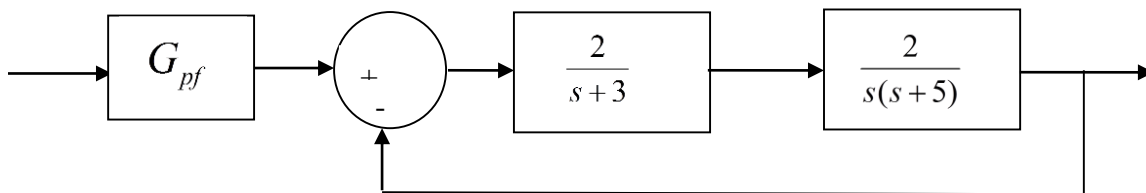The best estimate of the **steady state error** is     a) 0.5  b) 2.0  c) 1.0  d) ∞

**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



Ramp Response

**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 $G_p(s) = \dfrac{3}{s+4}$
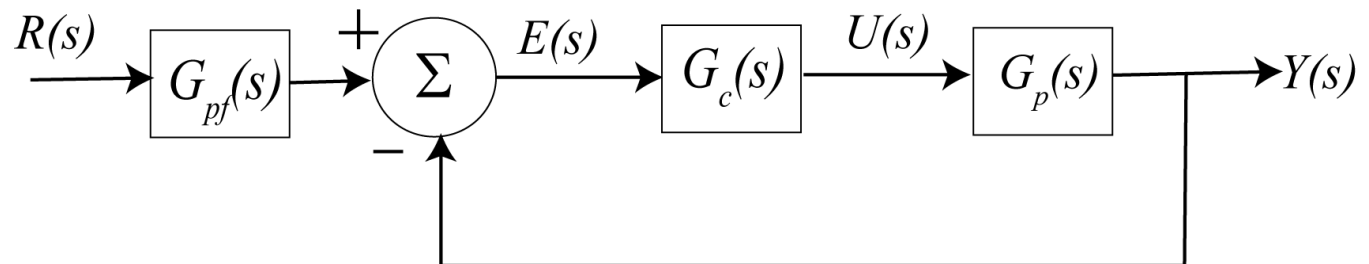
**17)** The (2%) settling time for this plant is

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 $G_p(s) = \dfrac{3}{s+4}$ 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 $G_p(s) = \dfrac{5}{(s+4)(s+2)}$
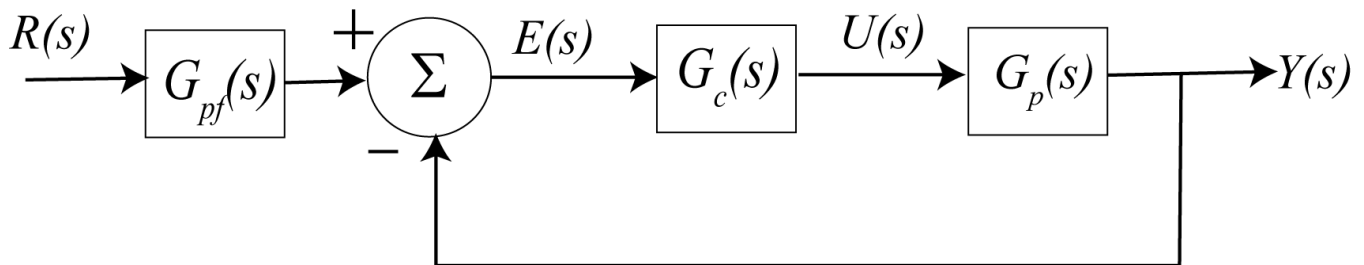
**22)** The (2%) settling time for this plant is

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:

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

**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

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

$$G_a(s) = \frac{s-1}{s+1}$$

$$G_b(s) = \frac{1}{s(s+1)}$$

$$G_c(s) = \frac{s}{s^2-1}$$

$$G_d(s) = \frac{s+1}{(s+1+j)(s+1-j)}$$

$$G_e(s) = \frac{(s-1-j)(s-1+j)}{s}$$

$$G_f(s) = \frac{(s-1-j)(s-1+j)}{(s+1-j)(s+1+j)}$$

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

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

**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*