ECE-205 Practice Quiz 8

(no Tables, Calculators, or Computers)

Problems 1 and 2 refer to the following transfer function $H(s) = \frac{2s+1}{(s+1)^2+4}$

1) For this transfer function, the corresponding impulse response $h(t)$ is composed of which terms?

a) $e^{-t}\cos(2t), e^{-t}\sin(2t)$ b) $e^{-2t}\cos(t), e^{-2t}\sin(t)$

c) $e^{-t}\cos(4t), e^{-t}\sin(4t)$ d) $e^{-4t}\cos(t), e^{-4t}\sin(t)$

2) The **poles** of the transfer function are

a) $2 \pm j$ b) $-2 \pm j$

c) $-1 \pm 2j$ d) $-1 \pm 4j$

Problems 3 and 4 refer to the impulse responses of six different systems given below:

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

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

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

5) 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 6 and 7 refer to the following impulse responses of six different systems

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

6) The number of (asymptitcally) **<u>unstable</u>** systems is   a) 1   b) 2   c) 3   d) 4

7) The number of (asymptotically) **<u>marginally stable</u>** systems is   a) 1   b) 2   c) 3   d) 4

Problems 8 and 9 refer to a system with poles at -2+5j. -2-5j. -10+j, -10-j, and -20

8) The best estimate of the **<u>settling time</u>** for this system is

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

9) The **<u>dominant pole(s)</u>** of this system are

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

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

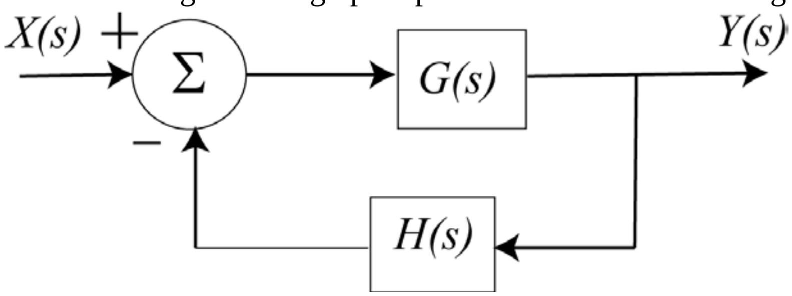
$$G_a(s) = \frac{s-1}{s+1} \qquad G_b(s) = \frac{s}{(s+1)} \qquad G_c(s) = \frac{s}{s^2-1}$$

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

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

For problems 11-15, consider the signal flow graph representation of the following block diagram.



11) The **path** is a) 1 b) G c) H d) GH e) none of these

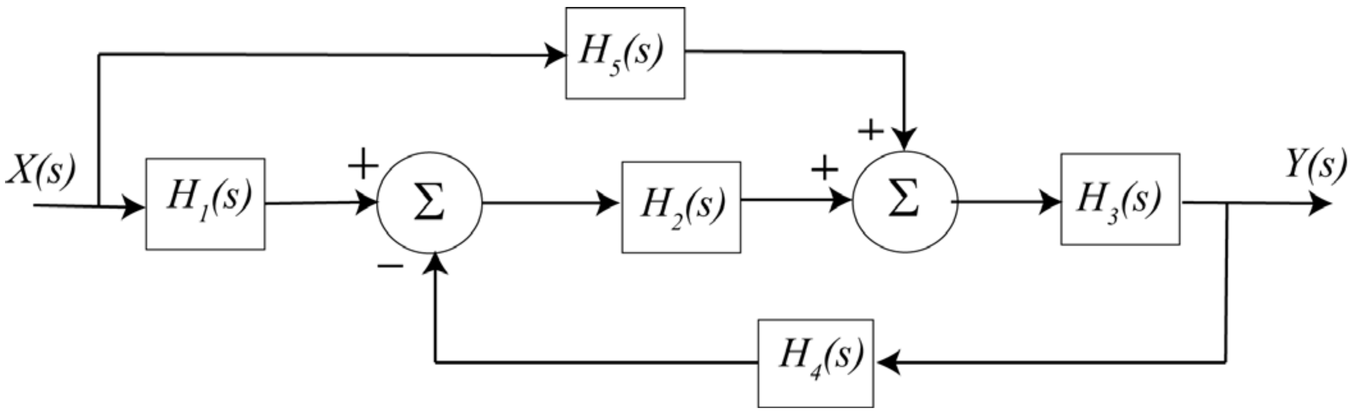
12) The **loop** is a) 1 b) G c) H d) GH e) none of these

13) The **determinant** (Δ) is a) 1 b) 1-GH c) 1+GH d) none of these

14) The **cofactor** is a) 1 b) G c) H d) GH e) none of these

15) The **transfer function** is a) 1 b) G c) GH d) $\frac{G}{1-GH}$ e) $\frac{G}{1+GH}$

For problems 16-19, consider the signal flow graph representation of the following block diagram.



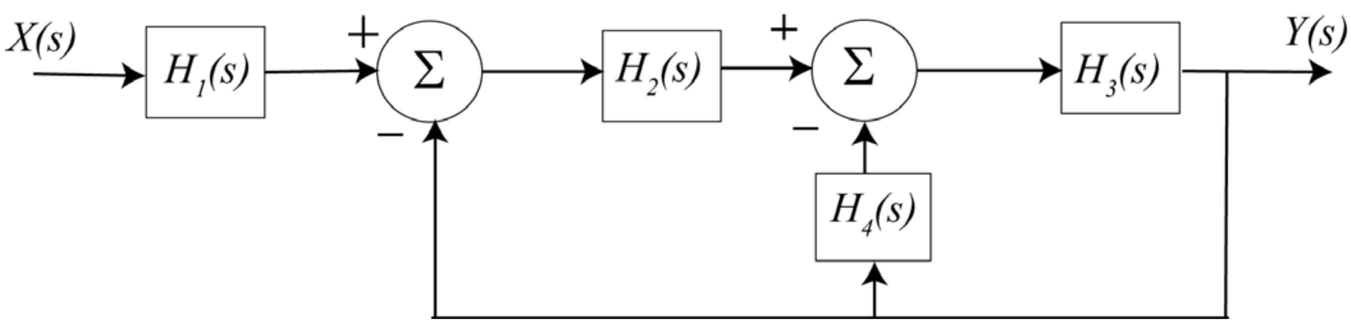
16) How many **paths** are there? a) 0 b) 1 c) 2 d) 3 e) 4

17) How many **loops** are there? a) 0 b) 1 c) 2 d) 3 e) 4

18) The **determinant** (Δ) is a) 1 b) $1-H_2H_3H_4$ c) $1+H_2H_3H_4$ d) none of these

19) The **transfer function** is a) 1 b) $\dfrac{H_3H_5+H_1H_2H_3}{1+H_2H_3H_4}$ c) $\dfrac{H_3H_5+H_1H_2H_3}{1-H_2H_3H_4}$

For problems 20 – 23 consider the signal flow graph representation of the following block diagram.



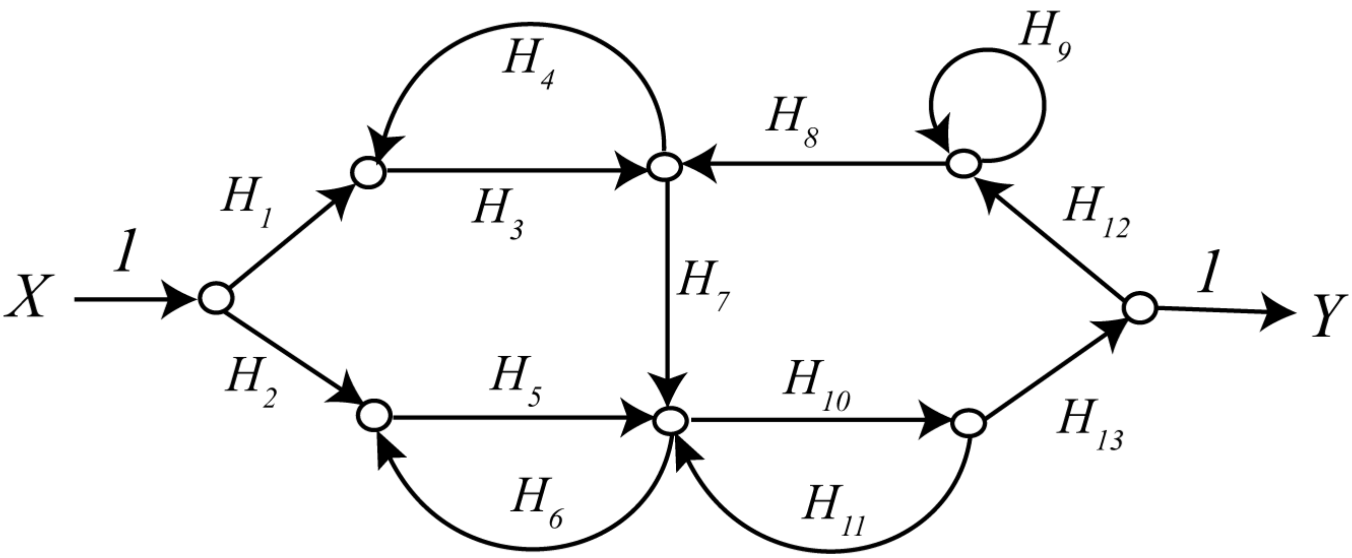
20) How many **paths** are there? a) 0 b) 1 c) 2 d) 3 e) 4

21) How many **loops** are there? a) 0 b) 1 c) 2 d) 3 e) 4

22) The **determinant** (Δ) is a) 1 b) $1-H_2H_3-H_3H_4$ c) $1+H_2H_3+H_3H_4$ d) none of these

23) The **transfer function** is a) 1 b) $\dfrac{H_1H_2H_3}{1-H_2H_3-H_3H_4}$ c) $\dfrac{H_1H_2H_3}{1+H_2H_3+H_3H_4}$

For problems 24-26 consider the following signal flow graph

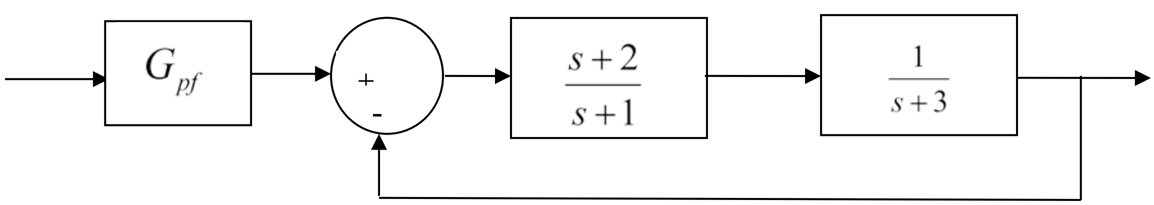


24) How many **paths** are there? a) 1 b) 2 c) 3 d) 4

25) How many **loops** are there? a) 2 b) 3 c) 4 d) 5 e) 6 f) 7

26) Are any of the **cofactors** equal to 1? a) yes b) no

27) 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

28) 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

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

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

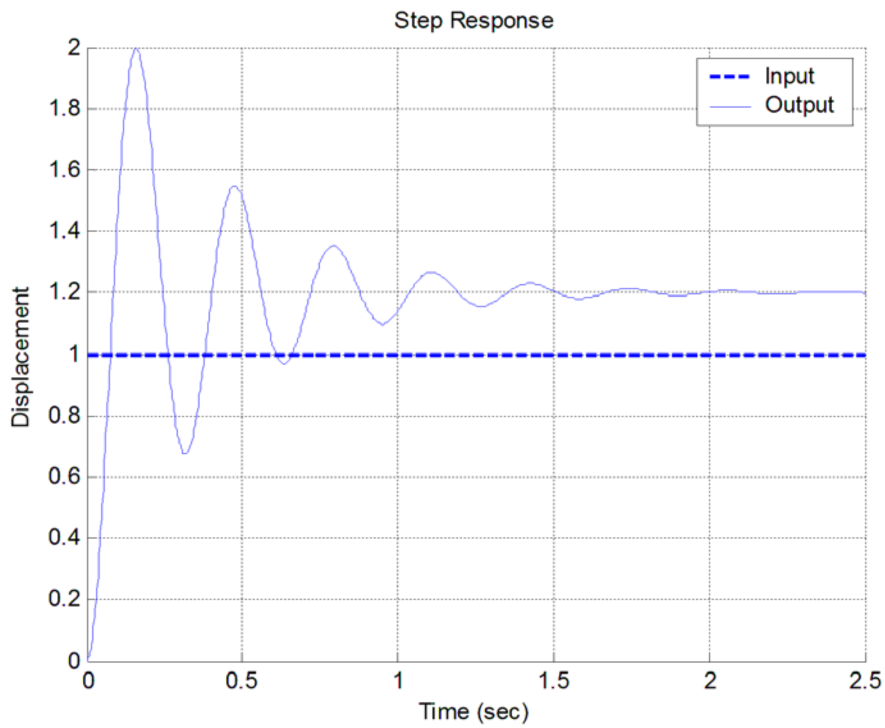
a) ∞ b) 0.5 c) 2.0 d) impossible to determine

30) 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 31 and 32 refer to the **unit step response** of a system, shown below



31) 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

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

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

33) 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

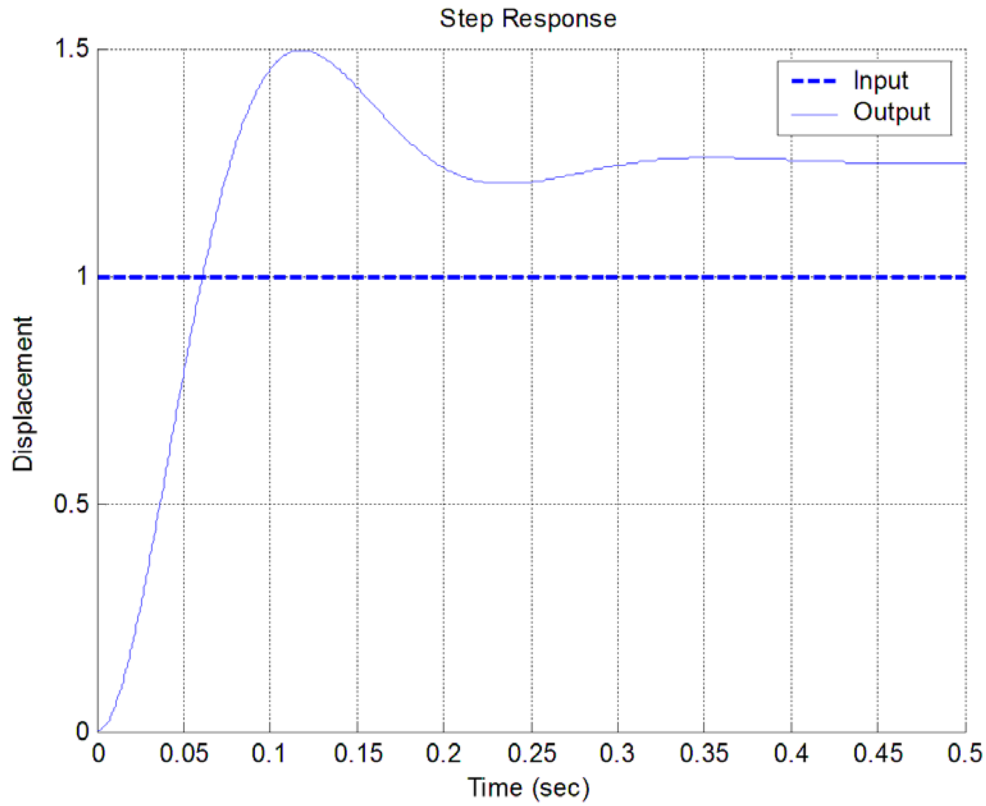
Problems 34 and 35 refer to the system described by the transfer function $G(s) = \frac{s+1}{(s+2)(s+3)}$

34) 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

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

Problems 36 and 37 refer to the **unit step response** of a system, shown below



36) 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

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

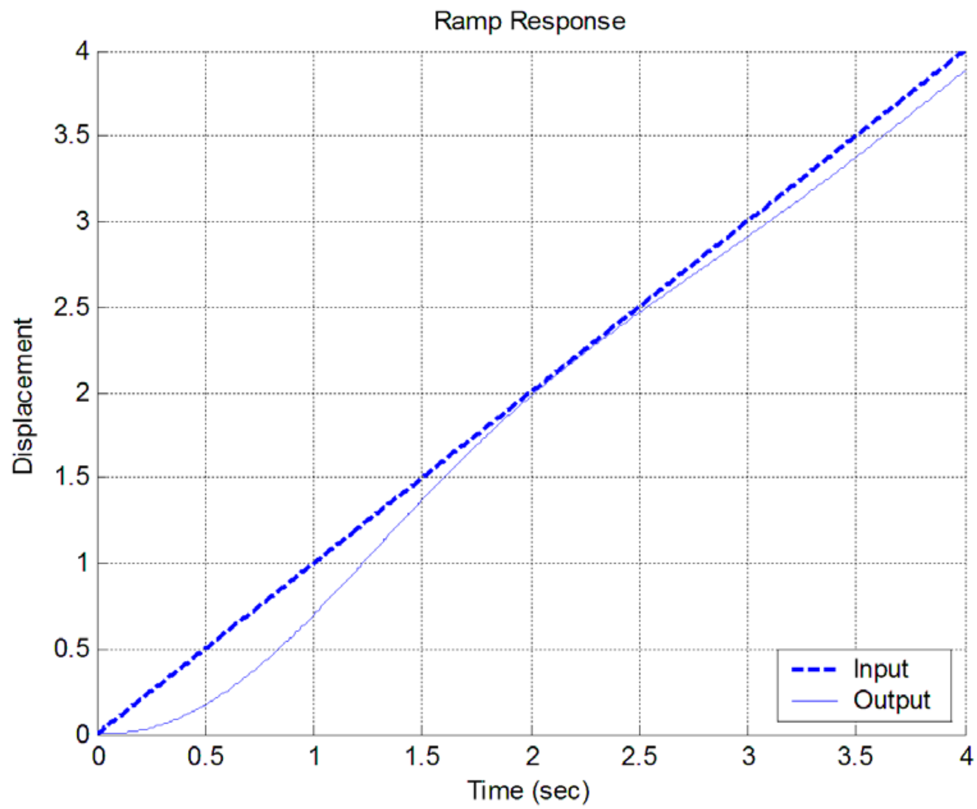
38) The **unit ramp response** of a system is given b $y(t) = -0.5u(t) - 2tu(t) + e^{-t}u(t)$.

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

a) 0.5 b) 2.0 c) 1.0 d) ∞

39) 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

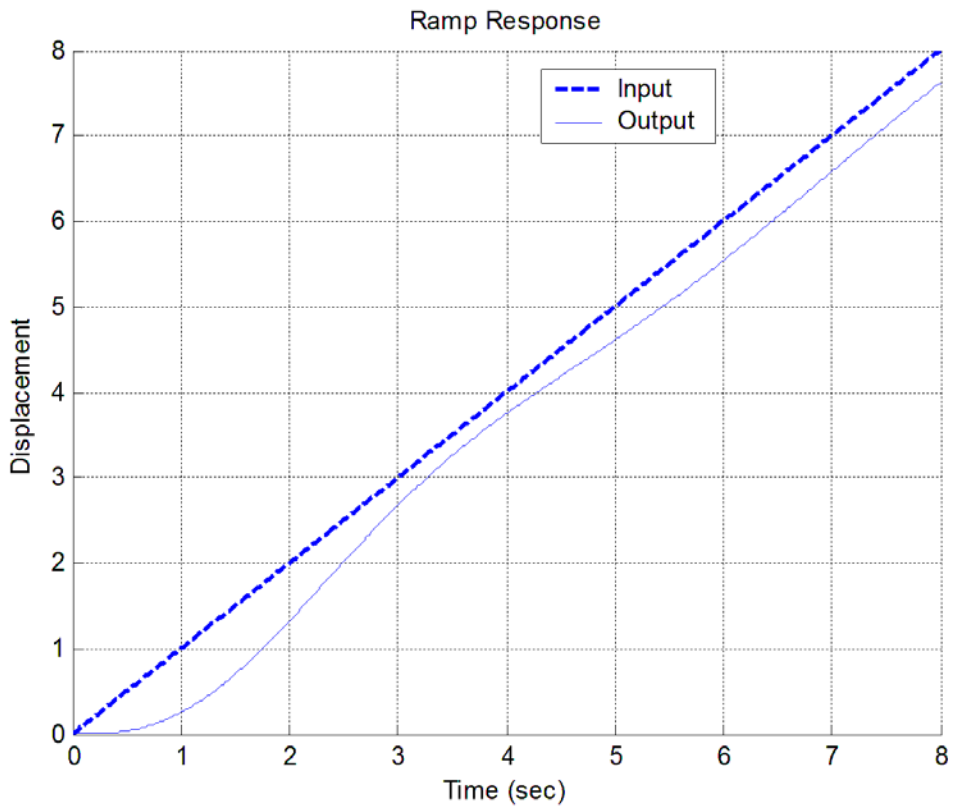


40) The **unit ramp response** of a system is given by $y(t) = -0.5u(t) + tu(t) + e^{-t}u(t)$.

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

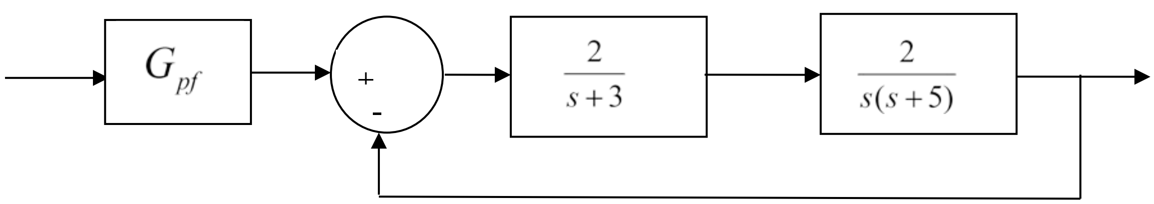
41) For the **unit ramp response** of a system shown below, the best estimate of the **steady state error** is

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



42) 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 43 and 44 refer to a plant with transfer function $G_p(s) = \frac{3}{s+4}$

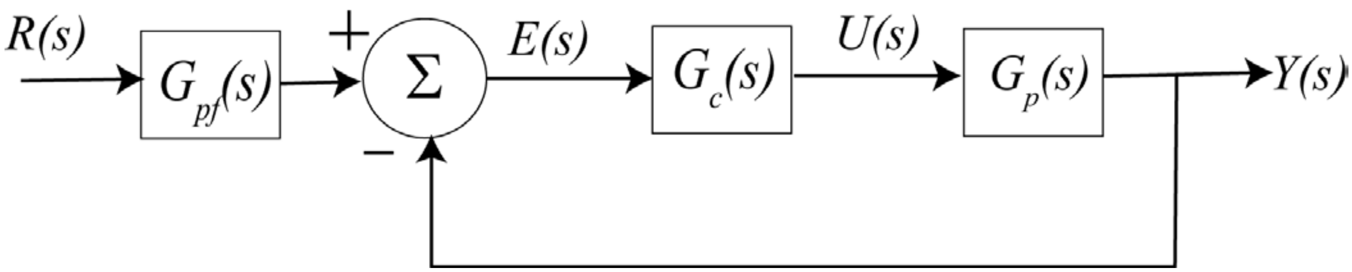
43) The (2%) settling time for this plant is

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

44) 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 **45-47** refer to the following feedback system, with the plant $G_p(s) = \frac{3}{s+4}$ and proportional controller, $G_c(s) = k_p$



45) 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

46) 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

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

Problems 48 and 49 refer to a plant with transfer function $G_p(s) = \dfrac{5}{(s+4)(s+2)}$

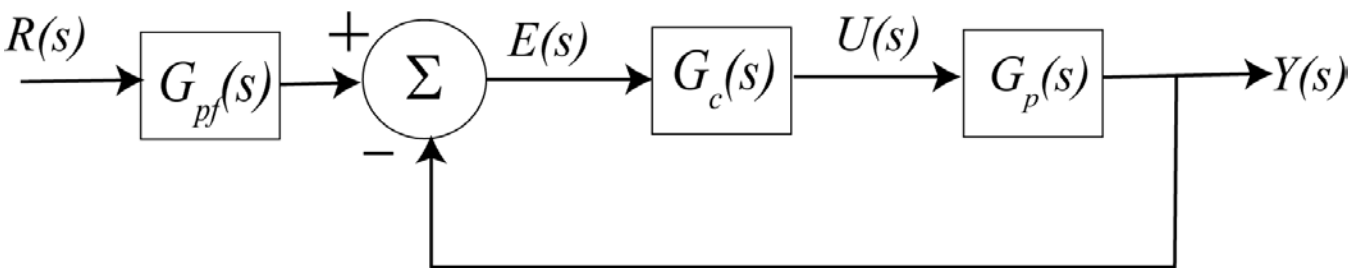
48) The (2%) settling time for this plant is

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

49) 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

Problem **50-** refers to the following feedback system, with the plant $G_p(s) = \dfrac{5}{(s+4)(s+2)}$ and proportional controller, $G_c(s) = k_p$



50) 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

Answers: 1-a, 2-c, 3-d, 4-b, 5-c, 6-b, 7-a, 8-a, 9-a, 10-a, 11-b, 12-e, 13-c, 14-a, 15-e, 16-c, 17-b, 18-c, 19-b, 20-b, 21-c, 22-c, 23-c, 24-b, 25-d, 26-b, 27-c, 28-a, 29-b, 30-c, 31-b, 32-c, 33-b, 34-d, 35-c, 36-c, 37-a, 38-d, 39-a, 40-a, 41-c, 42-a, 43-a, 44-b, 45-c, 46-c, 47-b, 48-b, 49-d, 50-d