

ECE-205

Exam 3

Spring 2010

Calculators and computers are not allowed. You must show your work to receive credit.

Problem 1 _____/20

Problem 2 _____/20

Problem 3 _____/20

Problem 4 _____/20

Problem 5 _____/20

Total _____

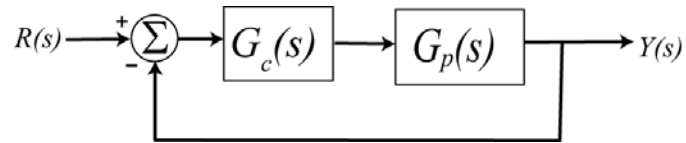
1) (20 points) For a system with transfer function

$$H(s) = \frac{3}{s^2 + 4s + 6}$$

determine the unit step response of the system:

Do not forget any necessary unit step functions.

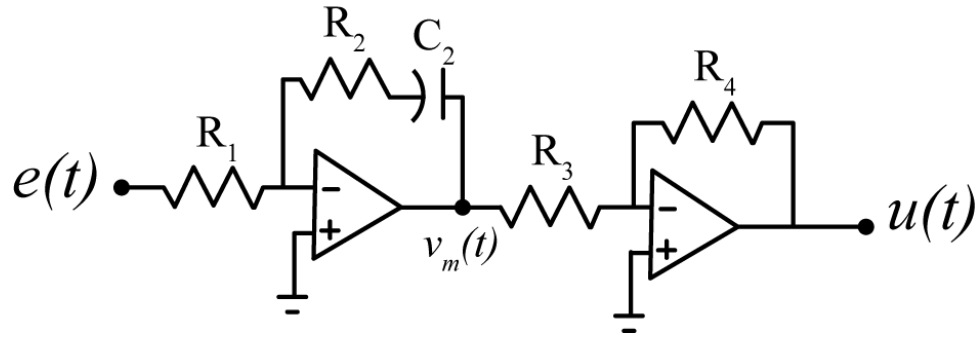
2) (20 points) Consider the following simple feedback control block diagram. The plant, the thing we want to control, has the transfer function $G_p(s) = \frac{2}{s+4}$



- a)** Determine the settling time of the plant alone (assuming there is no feedback)
- b)** For a proportional controller, $G_c(s) = k_p$, determine the closed loop transfer function $G_0(s)$ and then
- the settling time, in terms of k_p
 - the steady state error for a unit step, in terms of k_p
- c)** For an integral controller, $G_c(s) = \frac{k_i}{s}$, determine the closed loop transfer function $G_0(s)$ and the steady state error for a unit step in terms of k_i

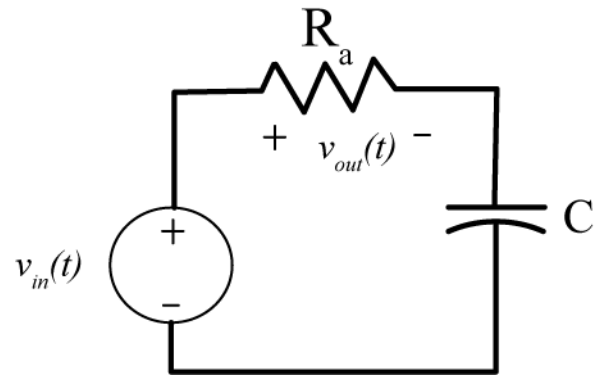
3) (20 points) Show that the following circuit can be used to implement the PI controller

$$G_c(s) = \frac{U(s)}{E(s)} = k_p + k_i \frac{1}{s}$$

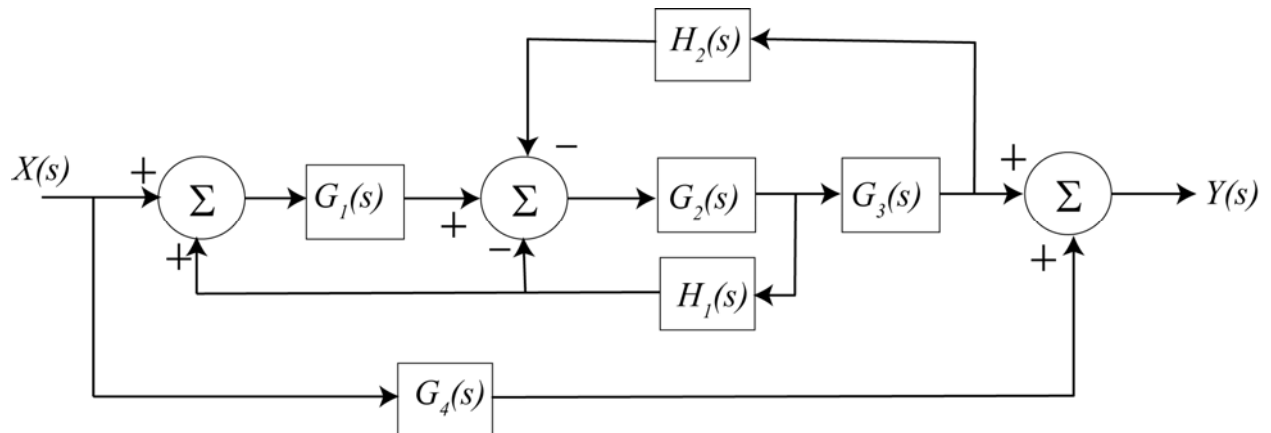


Determine expression for both k_p and k_i in terms of the parameters R_1, R_2, R_3, R_4, C_2

4) (20 points) For the following circuit determine the transfer function and the corresponding impulse response.



5) (20 points) For the following block diagram



- Draw the corresponding signal flow graph, labeling each branch and direction
- Determine the system transfer function using Mason's gain rule. You must simplify your final answer as much as possible.

Name _____ Mailbox _____

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