Name _____ Mailbox _____

ECE-205

Exam 2

Fall 2013

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

Problem 1 _____/15

Problem 2 _____/17

Problem 3 _____/18

Problem 4 _____/24

Problem 5 _____/26

Total _____

Name _____ Mailbox _____

1) (15 points) Simplify the following as much as posible. Be sure to include any necessary unit step functions

$$y(t) = [t + e^{t}]\delta(t-1)$$

$$y(t) = \int_{-\infty}^{t+1} \delta(\lambda+1)d\lambda$$

$$y(t) = \int_{-t-2}^{3} \delta(\lambda-2)d\lambda$$

$$y(t) = \int_{0}^{t} e^{-(t-\lambda)}e^{-2\lambda}d\lambda$$

$$y(t) = \int_{0}^{t} e^{-3(t-\lambda)}e^{-3\lambda}d\lambda$$

Name _____ Mailbox _____

2) (17 Points) Determine the ***impulse response*** for the following systems. Don't forget any necessary unit step functions

a) $y(t) = x(t) + \int_{-\infty}^{t-1} x(\lambda - 2) d\lambda$

b) $y(t) = \int_{-\infty}^{t} e^{-(t-\lambda)} x(\lambda + 2) d\lambda$

c) $\dot{y}(t) + 2y(t) = 3x(t-1)$

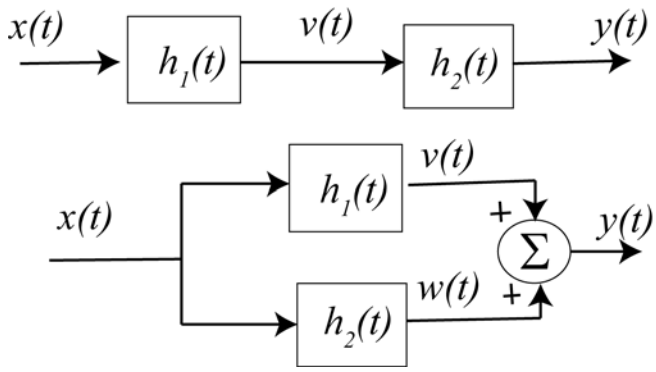
Name _____ Mailbox _____

3) (18 points) For the following block diagram

For the following interconnected systems,

i) determine the overall impulse response (the impulse response between input *x(t)* and output *y(t)*) and

ii) determine if the system is causal.



a) $h_1(t) = \delta(t),\ h_2(t) = \delta(t+2)$

b) $h_1(t) = e^{-t}u(t),\ h_2(t) = u(t-2) + \delta(t-2)$

Series Connections:

Parallel Connections:

Name _____ Mailbox _____

4) (24 points) Consider a linear time invariant system with impulse response given by

$$h(t) = e^{-t}[u(t-1) - u(t-3)]$$

The input to the system is given by two rectangular pulses, given by

$$x(t) = [u(t) - u(t-1)] + [u(t-2) - u(t-3)]$$

Using ***graphical evaluation***, determine the output $y(t)$ Specifically, you must

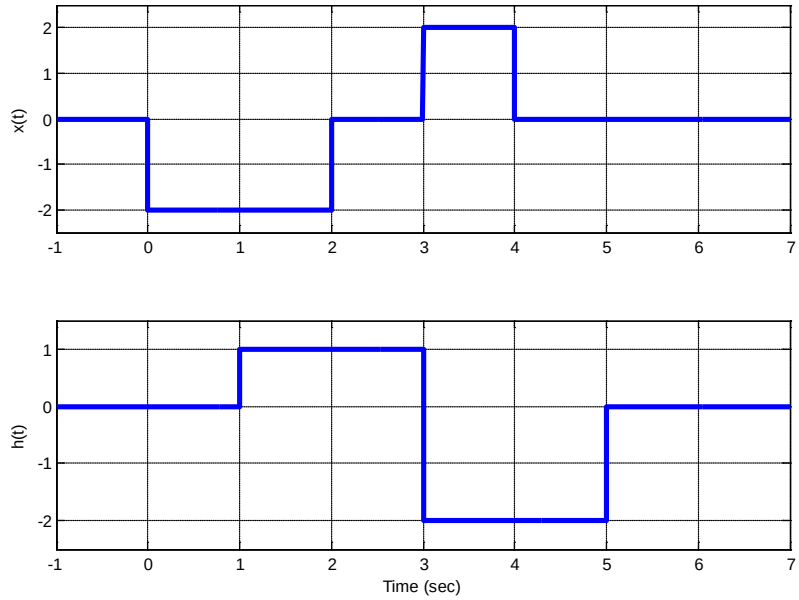
- Flip and slide $h(t)$, ***NOT*** $x(t)$
- Show graphs displaying both $h(t-\lambda)$ and $x(\lambda)$ for each region of interest
- Determine the range of t for which each part of your solution is valid
- Set up any necessary integrals to compute $y(t)$. Your integrals must be complete, in that they cannot contain the symbols $x(\lambda)$ or $h(t-\lambda)$ but must contain the actual functions.
- Your integrals **cannot contain any unit step functions**
- ***DO NOT EVALUATE THE INTEGRALS!!***

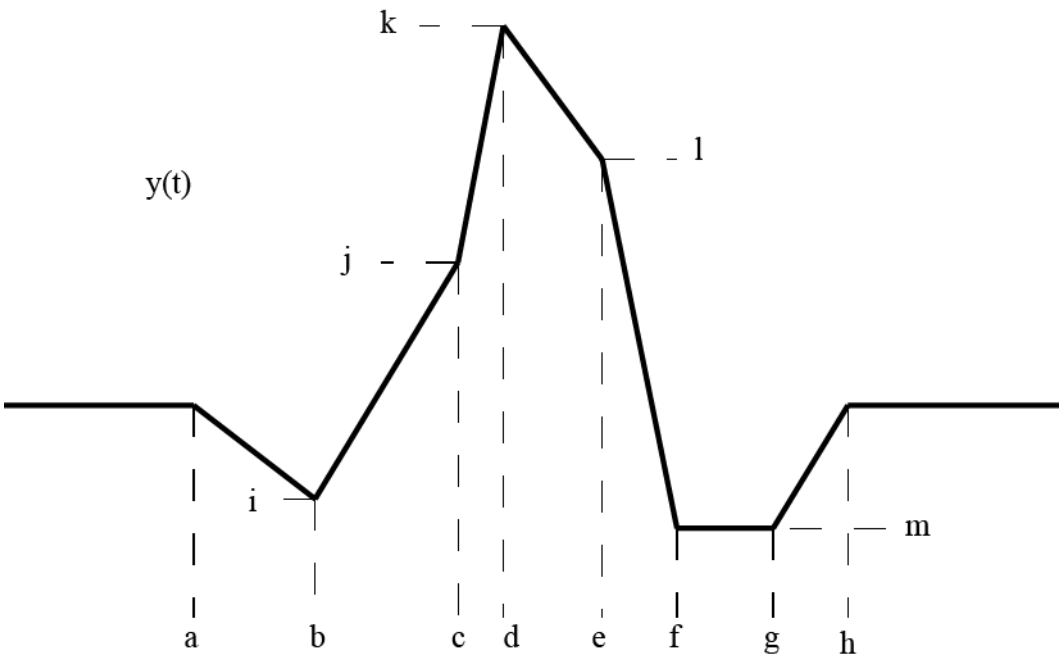
Name _____ Mailbox _____

5) (26 Points) An LTI system has input, impulse response, and output as shown below. Determine numerical values for the parameters *a-m.* Note that parameters *a-h* correspond to *times*, and *i-m* correspond to *amplitudes.*

Hints:

- *Note that the output is not drawn to scale, it just represents the general shape of the output.*
- *A good way to check your answer is to flip and slide one of them, then flip and slide the other one.*
- *It is probably much easier to get the times correct than the amplitudes.*





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