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ECE-205

Exam 2

Spring 2013

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

Problem 1 __________/18

Problem 2 __________/14

Problem 3 __________/15

Problem 4 __________/15

Problem 5 __________/15

Problem 6 __________/23

Total _______________

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1) (18 points) Fill in the non-shaded part of the following table. You do not need to show any work.

	Linear? (Y/N)	Time Invariant? (Y/N)	BIBO Stable? (Y/N)
$y(t) = \frac{1}{2}\left[x(t+1) + x(t-1)\right]$			
$\dot{y}(t) + e^t y(t) = \sin(t) x(t+1)$			
$y(t) = x\left(t-2\right)$			
$y(t) = \int_0^t e^{-\lambda} x(\lambda) d\lambda$			
$y(t) = \int_{-\infty}^t e^{\lambda} x(\lambda) d\lambda$			
$y(t) = t\, x(t)$			

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2) (14 points) Simplify the following as much as posible.

$$y(t) = e^t \delta(t-1)$$

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

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

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

For the following integrals you do not need to include any unit step functions in the answer.

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

$$y(t) = \int_{1}^{t} \lambda e^{-(t-\lambda)} e^{-\lambda} d\lambda$$

$$y(t) = \int_{2}^{t-1} e^{-3(t-\lambda)} e^{-\lambda} d\lambda$$

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3) (15 Points) Determine the ***impulse response*** for the following systems. Don't forget any necessary unit step functions

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

b) $y(t) = \int_{-\infty}^{t-1} e^{-(t-\lambda)} x(\lambda-2)\,d\lambda$

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

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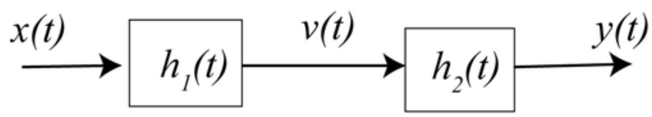
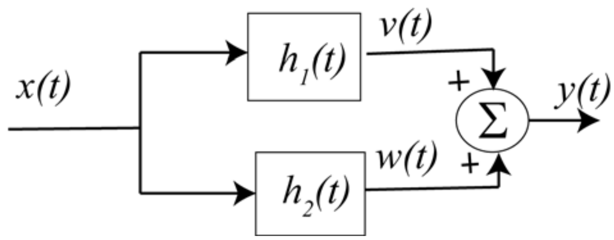
4) (15 points) For the following block diagram

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) $h_1(t) = e^{-(t+1)}u(t+1),\ h_2(t) = u(t-2) + \delta(t-2)$

Series Connections:

Parallel Connections:

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5) (15 points) Consider a linear time invariant system with impulse response given by

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

The input to the system is given by

$$x(t) = e^{-t}[u(t) - u(t-2)]$$

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!!***

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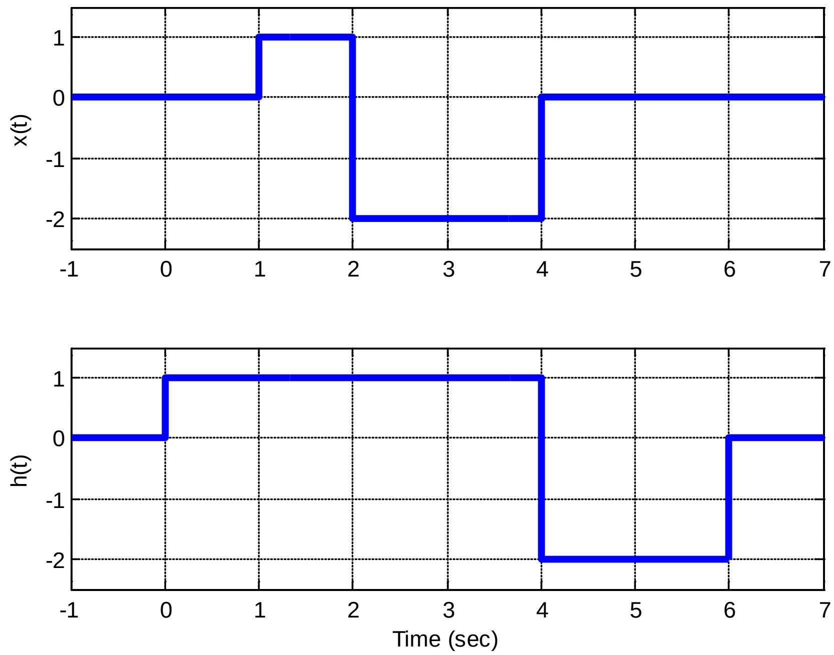
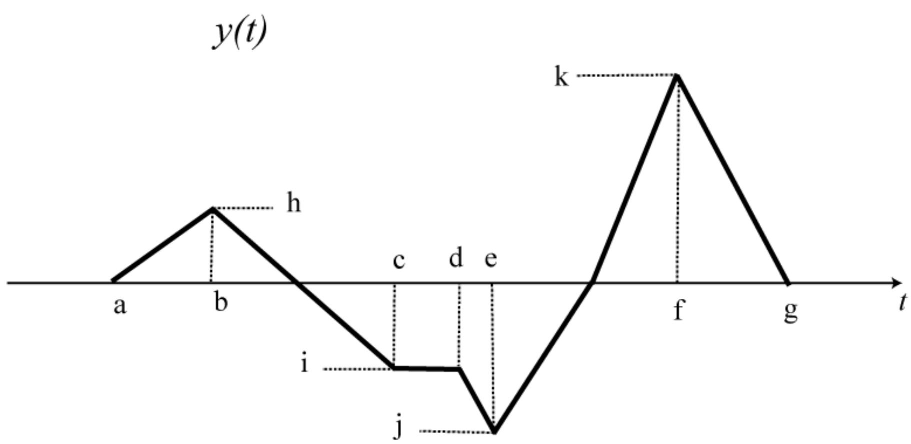
6) (23 Points) An LTI system has input, impulse response, and output as shown below. Determine numerical values for the parameters *a-k.* Note that parameters *a-g* correspond to *times*, and *h-k* correspond to *amplitudes.*





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