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ECE-205

Exam 2

Winter 2012

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

Problem 1 _________/18

Problem 2 _________/15

Problem 3 _________/18

Problem 4 _________/16

Problem 5 _________/13

Problem 6 _________/20

Total _______________

1) (18 points) Fill in the non-shaded part of the following table.

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

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2) (15 Points) Determine the ***impulse response*** for the following systems. Don't forget any necessary unit step functions

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

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

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

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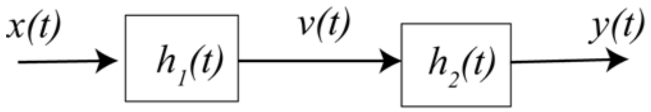
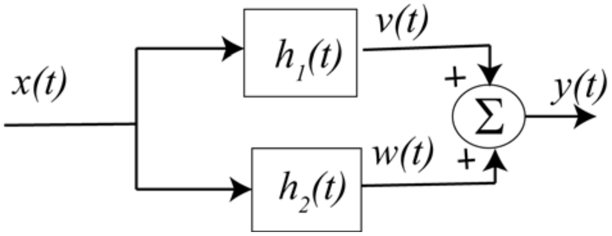
3) (18 points) For the following block diagram

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) $h_1(t) = \delta(t-1),\ h_2(t) = \delta(t+2)$

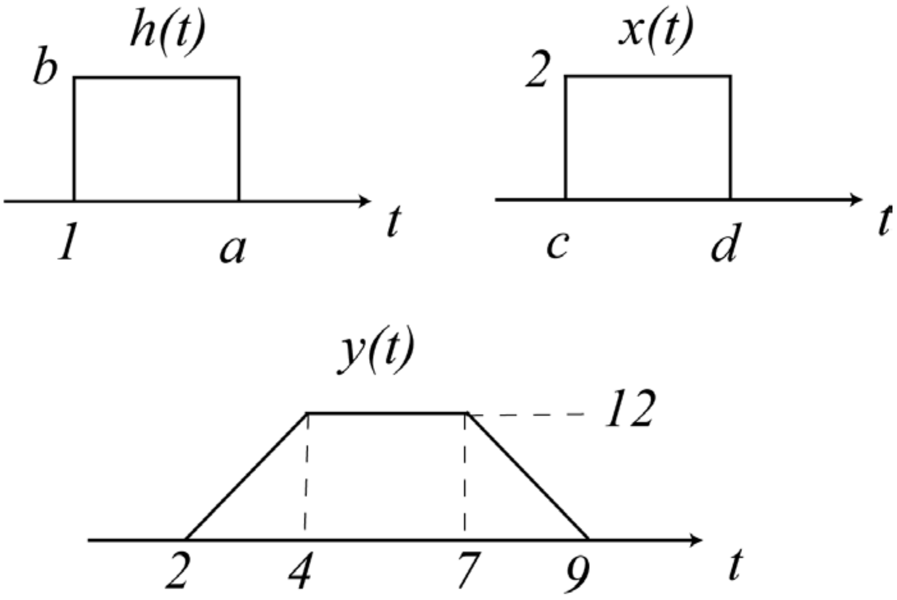
b) $h_1(t) = \mathrm{e}^{-t}u(t),\ h_2(t) = u(t-2) + \delta(t-2)$

Series Connections:

Parallel Connections:

4) (16 Points) An LTI system has impulse response, input, and output as shown below. Determine numerical values for the parameters *a, b, c, and d*.

Hint: $a-1 < d-c$

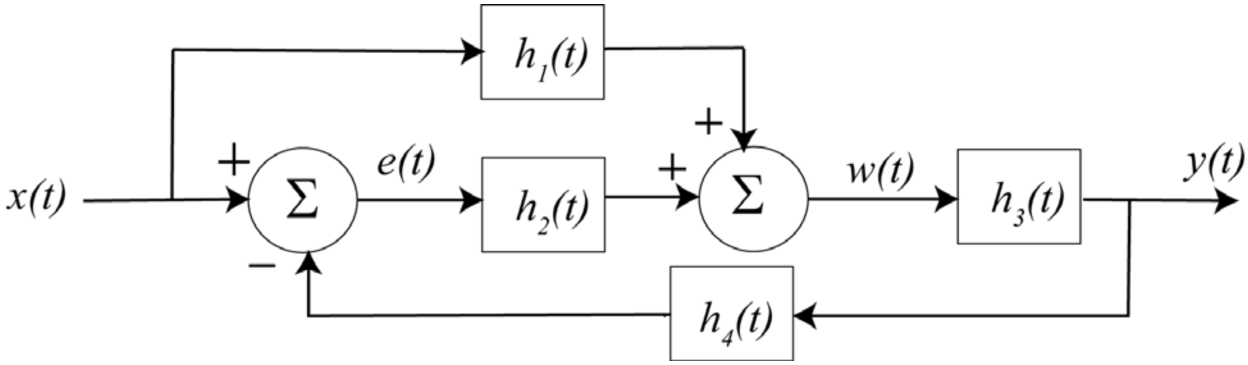


5) (13 points) The input-output relationship for the following system can be written as

$$y(t) * A(t) = x(t) * B(t)$$

Determine $A(t)$ and $B(t)$.

Hint: Determine an expression for *e(t)*, then *w(t)*, then *y(t)*



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6) (20 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

$$x(t) = e^{-t}[u(t) - u(t-1)] + 2u(t-2)$$

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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