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ECE-205

Exam 2

Winter 2013

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

Problem 1 __________/18

Problem 2 __________/20

Problem 3 __________/17

Problem 4 __________/25

Problem 5 __________/20

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)
$y(t) = 3x(t) + \cos(t)$			
$\dot{y}(t) + e^t y(t) = \sin(t) x(t+1)$			
$y(t) = t x(t-1)$			
$y(t) = \int_0^t e^{\lambda} x(\lambda) d\lambda$			
$y(t) = \int_{-\infty}^t \lambda x(\lambda) d\lambda$			
$y(t) = t \cos\left(\frac{1}{x(t)}\right)$			

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2) (20 points) Simplify the following as much as posible. Be sure to include any necessary unit step functions.

$$y(t) = [t^2 + e^{(t-1)}]\delta(t-1)$$

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

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

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

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

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3) (17 Points) Determine the ***impulse response*** for the following systems. Don't forget any necessary unit step functions

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

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

c) $\dot{y}(t) - 2y(t) = 4x(t+1)$

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4) (25 points) Use analytical evaluation to evaluate the following convolutions. Be sure to include any necessary unit step functions and simplify your answers.

a) $y(t) = \delta(t+1) * \delta(t-2)$

b) $y(t) = u(t+1) * \delta(t-1)$

c) $y(t) = \left[e^{-t}u(t)\right] * \delta(t-1)$

d) $y(t) = \left[e^{-(t-1)}u(t-1)\right] * u(t)$

e) $y(t) = \left[e^{-t}u(t)\right] * \left[e^{-(t-2)}u(t-2)\right]$

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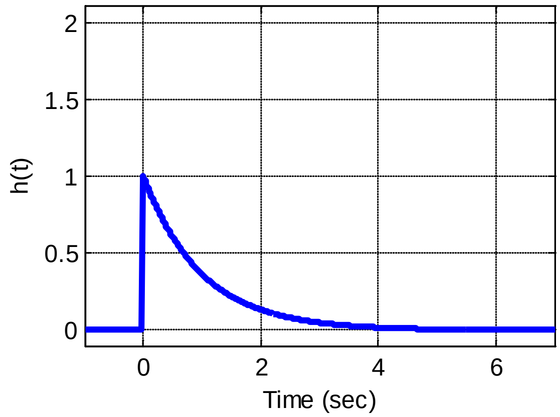
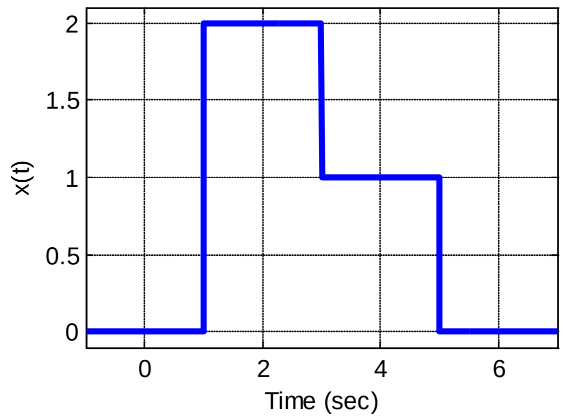
5) (20 points) Consider a linear time invariant system with impulse response given by

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

The input to the system is given by

$$x(t) = 2u(t-1) - u(t-3) - u(t-5).$$





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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