Midterm Exam 2

ECE205 Dynamical Systems

Midterm Exam 2
4/14/11

NAME: _____ CM: _____

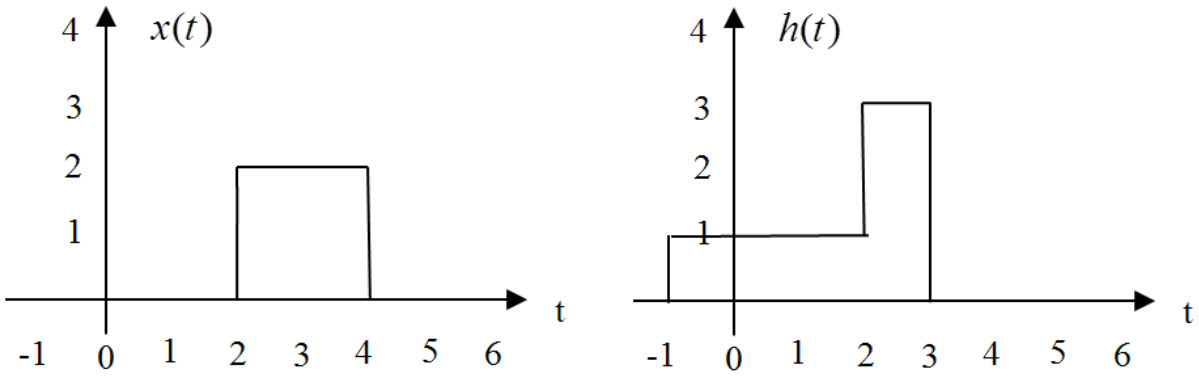
- You must **show work** to receive partial and full credit.
- Put a box around your final answer and it must include units, if necessary.
- Time allowed : 50 minutes.

Question #	Possible Points	Awarded Points
1	10	
2	30	
3	15	
4	15	
5	30	
Total	100	

Midterm Exam 2

1) (10 points)

A linear time invariant (LTI) system has the following input, x(t) and the impulse response, h(t). The output of the system, $y(t)$, is the convolution of the impulse response with the input, $y(t) = h(t) * x(t)$.



a) Is the system causal, why or why not?

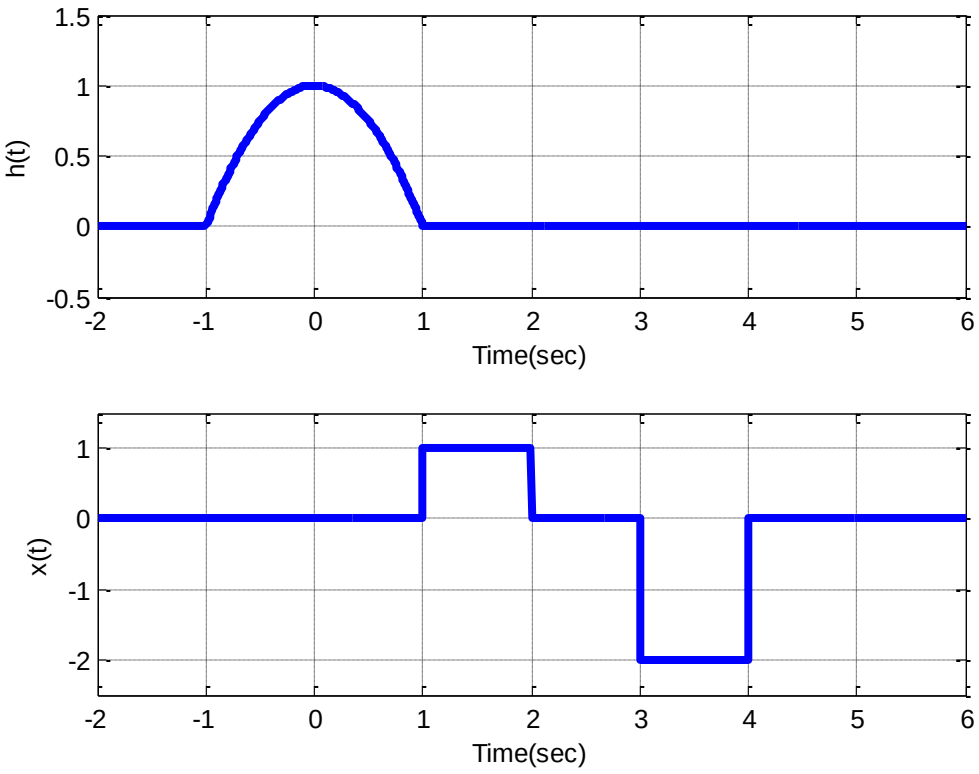
b) Is the system BIBO stable, why or why not?

Midterm Exam 2

2) (30 points) Consider a linear time invariant system with impulse response given by

$$h(t) = (1-t^2)[u(t+1)-u(t-1)]$$

The input to the system is given by $x(t) = [u(t-1)-u(t-2)]-2[u(t-3)-u(t-4)]$



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!!***

Problem 2 continued on the next page.

Midterm Exam 2

2) continued

Midterm Exam 2

3) (15 points) The LTI system in Figure 1 has the following input, $x(t)$, impulse response, $h(t)$, and output, $y(t)$. Use the convolution to determine the time parameters (*a, b, c, d*) and the amplitude, e. Note that these figures are not drawn to scale and you must show detailed work to justify your answer.

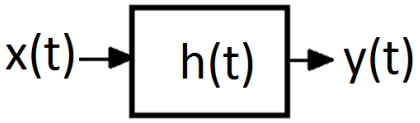
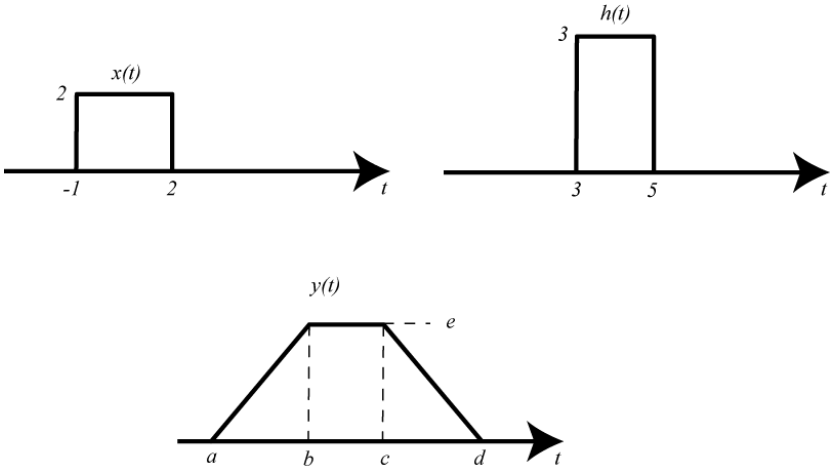


Figure 1. LTI system



Midterm Exam 2

4) (15 points)

For the following LTI systems, detrmine the **impulse response**.

a) $y(t) = 6x(t) + \int_{-\infty}^{t-1} e^{-(t+\lambda)} x(\lambda+3) d\lambda$

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

For the following LTI systems, detrmine the **step response**.

c) $y(t) = 6x(t) + \int_{-\infty}^{t-1} e^{-\lambda} x(\lambda) d\lambda$

Midterm Exam 2

5) (30 points) Fill in the following table with a Y (yes) or N (no) for each of the system models given. Assume $-\infty < t < \infty$ for all of the systems and all initial conditions are zero. *You do not need to show any work!*

System	System Model	Causal	Memoryless	Linear	Time-Invariant	BIBO Stable	Invertible
1	$y(t) = x(1-t)$						
2	$y(t) = \cos\left(\frac{1}{1+x(t)}\right)$						
3	$y(t) = x(t-1) + x(t-2)$						
4	$y(t) = tx(t)$						
5	$y(t) = \sqrt{x(t)}$						

Midterm Exam 2

Midterm Exam 2