

Homework #3

Review of Signals and Systems (cont'd)

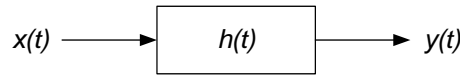
Total Points 150

Reading Assignment: Chapters 2, 3 and Related Course Notes

Assigned: Monday February 6, 2006  
 Due: Monday February 13, 2006

**Problem 1: (20 points) Convolution**

A simple communication system can be represented with the diagram

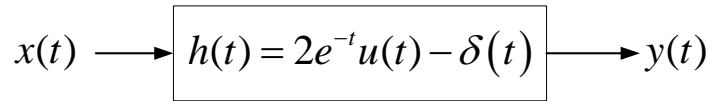


with the input  $x(t)$ , impulse response  $h(t)$ , and output  $y(t)$ . For each of the following input and impulse response combinations, find the output  $y(t)$ .

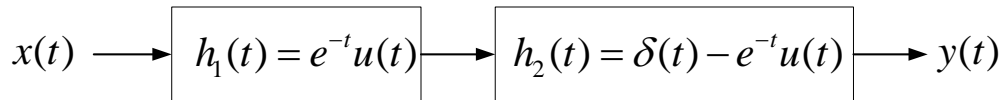
- a)  $x(t) = (1 - e^{-\alpha t})u(t)$ ,  $h(t) = e^{-\beta t}u(t)$ , assume  $\alpha, \beta > 0$ , and  $\alpha \neq \beta$
- b)  $x(t) = e^{-\alpha t} \cos(2\pi f_0 t) u(t)$ ,  $h(t) = e^{-\beta t} \sin(2\pi f_0 t) u(t)$ , assume  $\alpha, \beta > 0$ , and  $\alpha \neq \beta$

**Problem 2: (20 points) Convolution**

a) For the system shown below,



- Find the response  $y(t)$  when: i)  $x(t) = e^{-t}u(t)$ , ii)  $x(t) = \cos(t)$
- b) Find the response  $y(t)$  of the following cascaded systems for  $x(t) = e^{-t}u(t)$ .



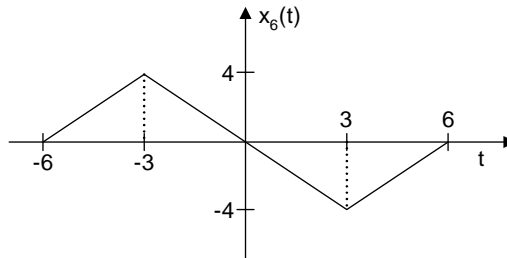
**Problem 3: (20 points) Fourier Transform**

Problem 3.3-2, (b), (c)

**Problem 4: (50 points) Fourier Transform**

Determine the Fourier Transform of each of the following signals.

- a)  $x_1(t) = \frac{1}{1+t^2}$
- b)  $x_3(t) = t \cos 2\pi f_c t$
- c)  $x_5(t) = e^{-|t|} \cos \beta t$
- d)



**Problem 5: (40 points) Inverse Fourier Transform**

Problem 3.1-6