King Fahd University of Petroleum & Minerals
Electrical Engineering Department
EE207: Signals and Systems (042)

Major Exam I

March 27, 2005
06:30 PM-08:00PM
Building 7-119

Serial #

-2 points for not writing your serial #

Name:_____

ID:_____

Sec. 1

Question	Mark
1	/14
2	/8
3	/7
4	/11
Total	/40

Instructions:

1. This is a closed-books/notes exam.
2. The duration of this exam is one and half hours.
3. Read the questions carefully. Plan which question to start with.
4. Write explicitly the formulas that you use in your solution (e.g. by KVL … by KCL). No credit will be given if you do not show your formulas.
5. Work in your own.
6. CLEARLY LABEL ALL SIGNIFICANT VALUES ON BOTH AXIES OF ANY SKETCH
7. Strictly no mobile phones are allowed.

Good luck

Dr. Ali Muqaibel

Problem 1: **(14 points)**

a. Evaluate the following integrals: **(2 points)**

$$\int_{-\infty}^{\infty} \cos(5\pi t)\delta(t)\,dt =$$

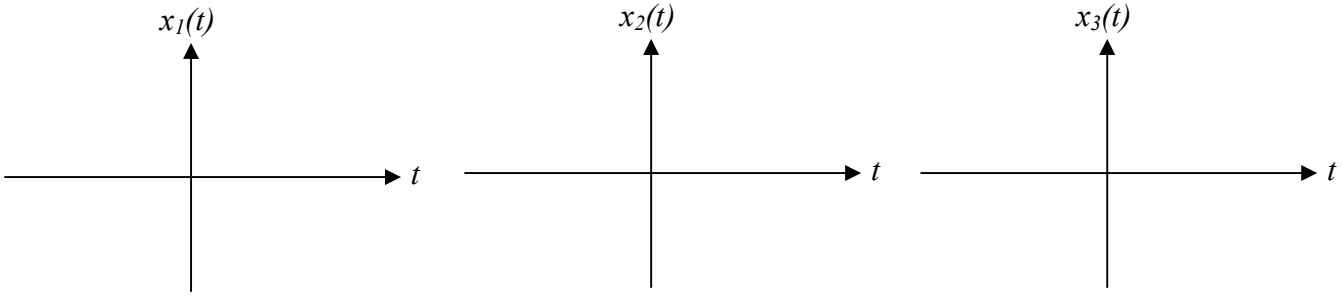
$$\int_{5}^{\infty} \cos(5\pi t)\delta(t)\,dt =$$

b. Sketch the following signals

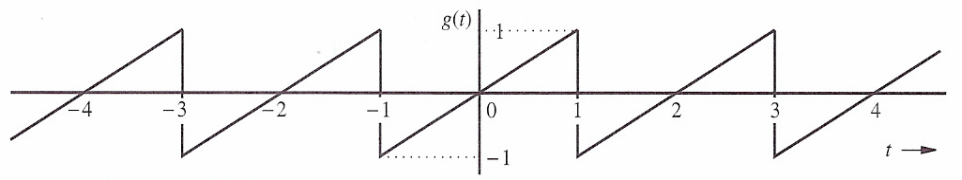
$x_1(t) = \cos(10\pi t - 3\pi)$

$x_2(t) = -\prod(2t + 4)$ **(6 points)**

$x_3(t) = 2u(t)u(2-t)$



c. Consider the signal shown in the figure below



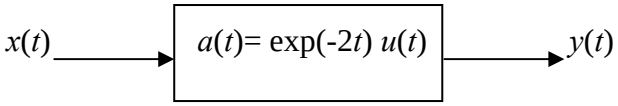
Find the power and energy. Is it a power signal or energy signal **(2 points)**

d. Sketch the double-sided amplitude and phase spectra of the signal **(4 points)**

$$x(t) = 4\sin\left(20\pi t - \frac{\pi}{6}\right) + 3\cos\left(30\pi t - \frac{\pi}{6}\right)$$

Problem 2: **(8 points)**

1. Consider the following LTI system characterized by its step response $a(t)$:



(1 point) a) For a given input signal $x(t)$ and a step response $h(t)$, give the general expression of the output signal $y(t)$ in terms of the convolution (or the superposition) integral.

(3 point) b) Suppose now that the step response is given by: $a(t) = \exp(-2t)u(t)$

If the input $x(t)$ is given by $x(t) = u(t) + 2u(t-5)+\delta(t-6)$, give the expression of the output $y(t)$ fot $t > 0$

(2 points) c) Show wither the given system is BIBO stable or not?

2. A system is defined by the input-output relationship **(2 points)**

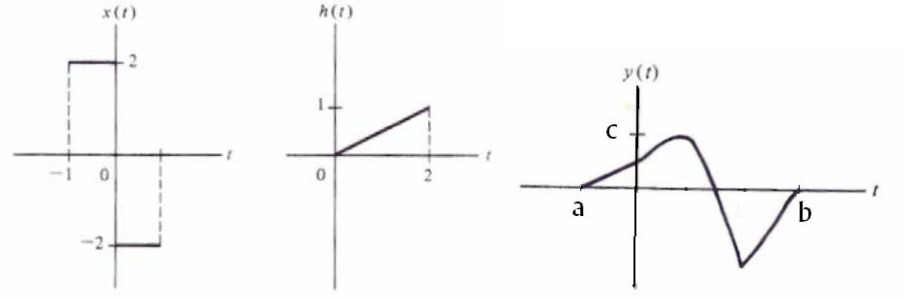
$y(t) = x(t^2)$

Is the system

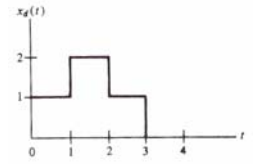
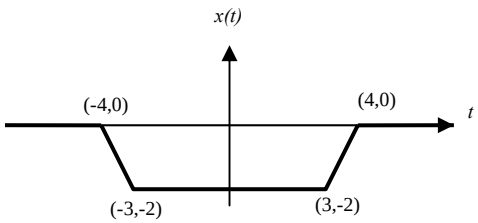
a) Causal? *why*
b) Fixed? *why*

Problem 3: **(7 points)**

1. For the following signals, $y(t) = x(t) * h(t)$. Find the value of *a* and *b*? **(3 points)**
What would be the value for *c* {0.3, 1, or 3}…. (*Show your steps to find a & b and to choose c. No grade will be given for final answer without steps*)

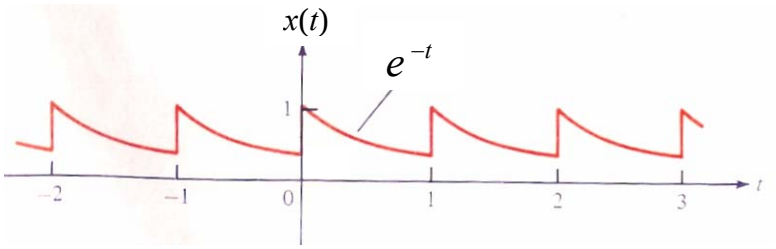


2. For the following two cases, sketch, y(*t*) which is given by the convolution o $y(t) = x(t) * h(t)$:
(4 points)
Hint: you can use the different forms of the super position integral to get the output, Let the input be any input x(t) in general and then find the output for the specific given h(t).

	$x(t)$		$h(t)$	$y(t)$
(a)		*	$\delta(t-2)$	
(b)		*	$\dot{\delta}(t)$	

Problem 4: (11 points)

For the shown signal, $x(t)$,



a) Obtain the complex exponential Fourier series. **(6 points)**

b) Obtain the trigonometric Fourier series coefficients a_0, a_n, & b_n. **(5 points)**

Hint: b_n should have the following form $\frac{4n\pi\left(1-e^{-1}\right)}{1+(2n\pi)^2}$, you can use this information to check your answer. Note even if you do not get the same answer, make sure that you have the right procedure.