King Fahd University of Petroleum & Minerals
Electrical Engineering Department
EE207: Signals & Systems (121)

Major Exam I

Oct. 10, 2012
6:00-7:30 PM
Building 59

Name: ___________________________

ID#_______________________________

Question	Mark
1	
2	
3	
Total	

Instructions:

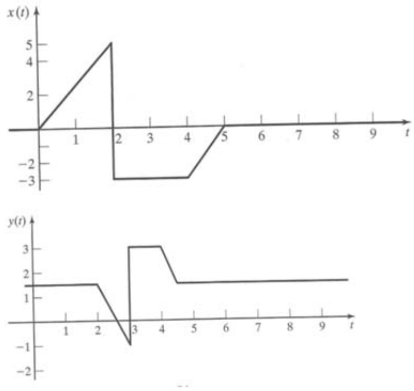
1. This is a closed-books/notes exam.
2. The duration of this exam is one and half hours.
3. Read the questions carefully. Plan which question to start with.
4. CLEARLY LABEL ALL SIGNIFICANT VALUES ON BOTH AXIES OF ANY SKETCH
5. Work in your own.
6. Strictly no mobile phones are allowed. Do not even look at them !

Good luck

Mark	sec	**Timing**	**Instructor**
	1	UT 8:30	Dr. M. Landolsi
	3	UT 10:00	Dr. Ali Al-Shaikhi
	4	SMW 10:00	Dr. Azzedine Zerguine
	5	SMW 11:00	Dr. Ali Muqaibel

Problem 1: **Choose the best answer. Fill in the table with CLEAR answer**

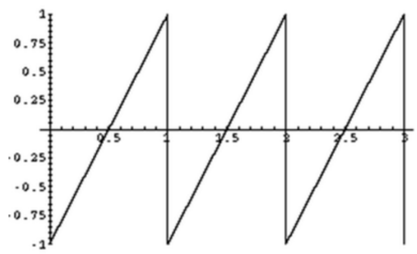
Question	1	2	3	4	5	6	7	8	9	10	11	12	13
Answer													



1. **The two shown signals $y(t)$ and $x(t)$ are related by:**
   a) $y(t) = -0.5x(2t+1) + 1.5$
   b) $y(t) = 2x(-t) - 1.5$
   c) $y(t) = -2x(2t) + 1.5$
   d) $y(t) = -2x(0.5t+1) + 1.5$
   e) $y(t) = -0.5x(2(t-2)) + 1.5$

2. **The value of** $\int_{-\infty}^{+\infty}\left[e^{\propto t^2}\delta(t-10) + \sin(3\pi t)\,\delta(t)\right]dt =$
   a) 0
   b) $e^{100\propto}$
   c) 1
   d) $e^{100\propto} + 1$
   e) $e^{\propto t^2} + \sin(3\pi t)$

3. **For the periodic sawtooth signal shown in the figure, the power is equal to**
   a) 2
   b) 1
   c) ½
   d) 1/3
   e) 0



4. **A system is described by the following impulse response $h(t) = u(t+1) + \delta(t)$, the system is**
   a) Causal, Bounded Input Bounded Output (BIBO) stable, has memory (dynamic)
   b) Noncausal, Bounded Input Bounded Output (BIBO) stable, memoryless (static)
   c) Noncausal, not Bounded Input Bounded Output (BIBO) stable, has memory (dynamic)
   d) Causal, not Bounded Input Bounded Output (BIBO) stable, memoryless (static)
   e) Causal, not Bounded Input Bounded Output (BIBO) stable, has memory (dynamic)

5. **A causal linear Time-invariant system has the impulse response, $h(t) = \frac{1}{3}\,e^{-\frac{t}{3}}u(t)$. If the input signal is $2u(t-5)$, then the output is**
   a) $2\left(1 - e^{\frac{-(t-5)}{3}}\right)u(t-5)$
   b) $\frac{2}{9}\left(1 - e^{\frac{-(t-5)}{3}}\right)u(t-5)$
   c) $\frac{2}{3}\,e^{-\frac{(t-5)}{3}}u(t-5)$
   d) $\frac{1}{3}\,e^{-\frac{t}{3}}u(t).\,2u(t-5)$
   e) This input cannot be applied because the system is causal

6. Which of the following statements is true?

a) For a linear time invariant system, the step response, $s(t)$, is related to the impulse response, $h(t)$, by $s(t) = \int_{-\infty}^{\infty} h(t)dt$.

b) Even functions are symmetric about the x-axis.

c) The following system $y(t) = 5 + x(t) + x(t^2)$ is memoryless

d) In the complex exponential Fourier representation, the complex coefficient C_0 is always real number.

e) $\delta(t)\cos(2\pi t) = 1$

7. A system made of four subsystems connected as shown in the Figure. Every system is expressed with its impulse response. The overall impulse response is given by:

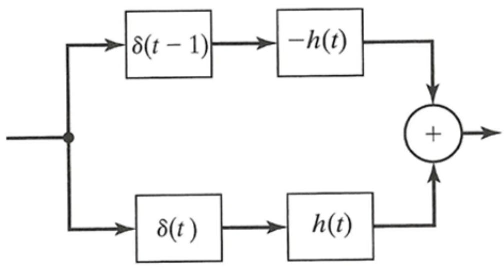
a) $-\delta(t-1)h(t) + \delta(t)h(t)$

b) $-h(t) + h(t)$

c) $\delta(t-1) + \delta(t)$

d) $\delta(t) - \delta(t-1)$

e) $h(t) - h(t-1)$



8. The value of $\int_{-1}^{5} e^{-4t^2} \cos(t^2)\delta(t-10)dt =$

a) $e^{-400}\cos(100)\delta(t-10)$

b) $e^{-400}\cos(100)$

c) $\delta(t-10)$

d) $e^{-400}\sin(100)$

e) 0

9. The system defined by the input output relationship …………………is a causal system.

a) $y(t) = x(-t)$

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

c) $y(t) = x(t^{\frac{1}{2}})$

d) $y(t) = x(t) + t - 1$

e) $y(t) = x(t+5) - 5$

10 The signal shown can be represented by:

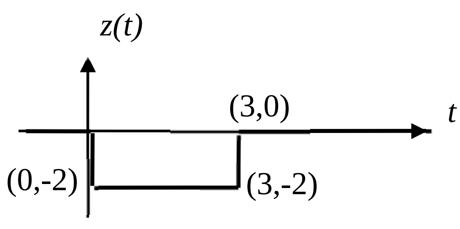
a) $-u(t)+u(t-3)$

b) $-2u(t) \times u(-t+3)$

c) $-3u(t) \times u(-t-2)$

d) $-3u(-t) \times rect(-t-2)$

e) –z(t)



11. Let $s(t) = e^{t-1}u(t+1)$ be the step response of a linear time invariant system. The unit impulse response, $h(t)$, for this system is:

a) $h(t) = e^{t-1}u(t+1)$
b) $h(t) = e^{t-1}u(t+1) + e^{-2}\delta(t+1)$
c) $h(t) = e^{t-1}\delta(t+1)$
d) $h(t) = e^{t-1}u(t+1) + \delta(t+1)$
e) $h(t)$ cannot be found from $s(t)$

12. Evaluate $\cos\left(\frac{\pi t}{5}\right) * \delta(t) * \delta(t-3)$=

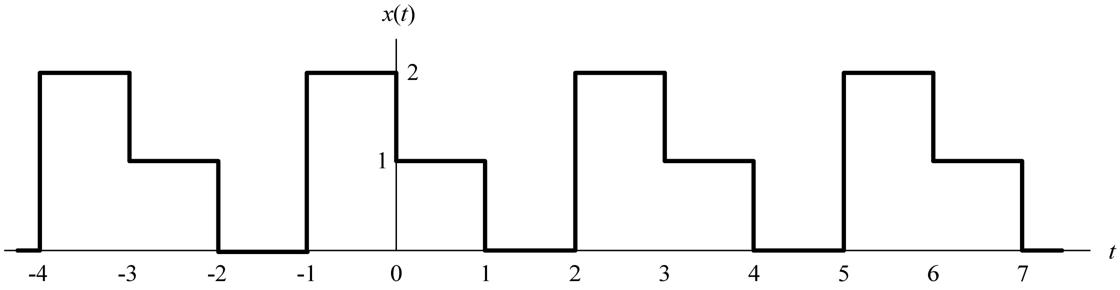
a) $\cos\left(\frac{\pi t}{5}\right)$
b) $\cos\left(\frac{\pi}{5}\right)$
c) $\cos\left[\frac{\pi}{5}(t-3)\right]$
d) $\delta(t)$
e) $\cos\left(\frac{3\pi}{5}\right)$

13. Given that $x(t) = 6e^{-6t}u(t)$, the energy of $x(t)$ is:

a) 0.5
b) 1.0
c) 3.0
d) 6.0
e) 4.0

Problem 2:

Part 1: Consider the signal $x(t)$ shown in the following figure.



a) Find the period T_0 and the fundamental frequency ω_0 for the signal $x(t)$.
b) Compute the complex Fourier coefficients C_k.
c) Find the trigonometric Fourier series coefficients $A_0,\ A_1$, and B_3.

$T_0 =$ $\omega_0 =$

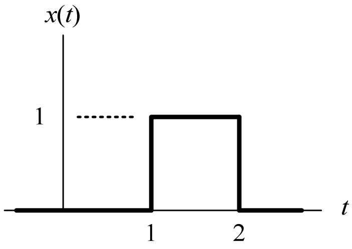
<u>Problem 2:</u>

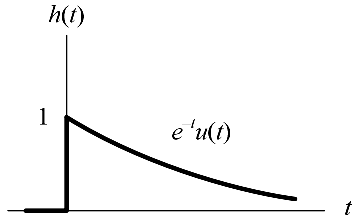
Part 2: For a signal with complex Fourier series coefficients:
$C_0 = 0$ and $C_k = \frac{-3j}{k\pi}\left[cos\left(\frac{k\pi}{2}\right) - 1\right]$, $k > 0$.

a) Plot the two-sided magnitude spectrum (up to the 4^{th} harmonic).
b) Plot the two-sided phase spectrum (up to the 4^{th} harmonic).

<u>Problem 3</u>:

Part 1. Find $y(t) = x(t) * h(t)$ for the two signals shown below:





Part 2. Find $y(t) = x(t) * h(t)$ for the two signals shown below: