GEORGIA INSTITUTE OF TECHNOLOGY

SCHOOL of ELECTRICAL & COMPUTER ENGINEERING

QUIZ #3

DATE: 17-Mar-06 COURSE: ECE-2025

NAME: _____ GT #: _____

LAST, FIRST (ex: gtz123q)

3 points | 3 points | 3 points

Recitation Section: Circle the date & time when your **Recitation Section** meets (not Lab):

	L05:Tues-Noon (Juang)		L06:Thur-Noon (Verriest)
	L07:Tues-1:30pm (Juang)		
L01:M-3pm (McClellan)	L09:Tues-3pm (Chang)	L02:W-3pm (Zhou)	L10:Thur-3pm (Taylor)
L03:M-4:30pm (Fekri)	L11:Tues-4:30pm (Chang)	L04:W-4:30pm (Zhou)	

- Write your name on the front page ONLY. **DO NOT** unstaple the test.
- Closed book, but a calculator is permitted.
- One page ($8\frac{1}{2}'' \times 11''$) of **HAND-WRITTEN** notes permitted. OK to write on both sides.
- **JUSTIFY** your reasoning clearly to receive partial credit.
  Explanations are also ***required*** to receive **FULL** credit for any answer.
- You must write your answer in the space provided on the exam paper itself.
  Only these answers will be graded. Circle your answers, or write them in the boxes provided.
  If space is needed for scratch work, use the backs of previous pages.

Problem	*Value*	*Score*
1	25	
2	25	
3	25	
4	25	
No/Wrong Rec	$-\lfloor \pi \rfloor$	

PROBLEM Spring-06-Q.3.1:

In each of the following cases, use properties of the unit-impulse function to simplify the expression ***as much as possible.*** Provide some **explanation** or intermediate steps for each answer. *Note:* Star $*$ is the convolution operator.

(a) Simplify $H(j\omega) = \delta(\omega - 8\pi) * \sum_{\ell=0}^{2} \sin(\omega/12)\, \delta(\omega - 3\pi\ell)$

(b) Simplify $q(t) = \int_{-\infty}^{t-9} \delta(\tau - 7)\, \sqrt{4(\tau - t)}\, d\tau$

(c) Simplify $x(t) = \frac{d}{dt}\left\{\sqrt{3t}\, u(t - 12)\right\}$

PROBLEM Spring-06-Q.3.2:

In each of the following cases, determine the (inverse or forward) Fourier transform. Give your answer as a plot, or a simple formula (two of the answers will be ***real-valued.***)

Explain each answer (briefly) by stating which property and/or transform pair you used.

(a) Find $s(t)$ when $S(j\omega) = \dfrac{\sin(\omega/4)}{\omega/8}\, e^{-j\omega/2}$.

(b) Find $h(t)$ when $H(j\omega) = \dfrac{1000\, j\omega}{1000 + j50\omega}$.

(c) Find $X(j\omega)$ when $x(t) = \sqrt{e}\, \cos(377t + 0.3\pi)$.

PROBLEM Spring-06-Q.3.3:
Two questions about convolution:

(a) Find $y(t) = e^{-8(t-3)}u(t-3) * 5u(t-9)$. Give the answer as a **simple** formula.

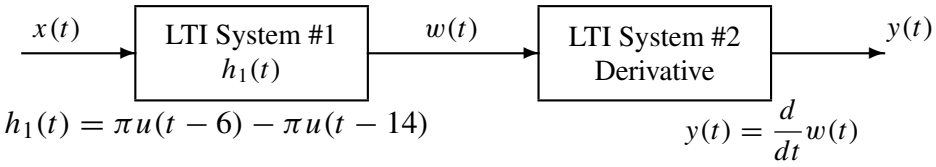
(b) If the signal $r(t)$ is a rectangular pulse, then $r(t) * r(t)$ is a triangle. Suppose that

$$r(t) * r(t) = y(t) = \begin{cases} 100\,t & \text{for } 0 \le t \le 40 \\ 4000 - 100(t-40) & \text{for } 40 \le t \le 80 \\ 0 & \text{elsewhere} \end{cases}$$

Determine the rectangular signal $r(t)$.

PROBLEM Spring-06-Q.3.4:

A cascade of linear time-invariant systems is depicted by the following block diagram:



$h_1(t) = \pi u(t-6) - \pi u(t-14)$

$y(t) = \dfrac{d}{dt} w(t)$

(a) Determine the overall impulse response for this cascade of two systems. Give your answer in the ***simplest possible form.***

(b) The overall frequency response of this system, $H(j\omega)$, is zero for infinitely many values of ω. Derive a general formula that gives **all** the zeros of $H(j\omega)$. ***Explain.***