GEORGIA INSTITUTE OF TECHNOLOGY

SCHOOL of ELECTRICAL & COMPUTER ENGINEERING

QUIZ #4

DATE: 22-Apr-05 COURSE: ECE-2025

NAME: _____ GT #: _____

LAST, FIRST (ex: `gtz123z`)

3 points 3 points 3 points

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

	L05:Tues-Noon (Chang)		L06:Thur-Noon (Ingram)
	L07:Tues-1:30pm (Chang)		L08:Thurs-1:30pm (Zhou)
L01:M-3pm (Williams)	L09:Tues-3pm (Casinovi)	L02:W-3pm (Juang)	L10:Thur-3pm (Zhou)
L03:M-4:30pm (Casinovi)	L11:Tues-4:30pm (Casinovi)	L04:W-4:30pm (Juang)	GTSav: (Moore)

- 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 Rec	-3	

PROBLEM s-05-Q.4.1:

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

(a) $\left.\dfrac{\sin(9\omega/2)}{4\omega}\right|_{\omega=0}$ (i.e., evaluate at $\omega = 0$)

(b) $(\delta(t) + \delta(t-3)) * (\delta(t-4) - \delta(t-1))$

(c) $\left\{e^{-(t+5)^2}u(t+5)\right\} * h(t) = 5e^{-t^2}u(t)$ (find $h(t)$ that satisfies this equation)

(d) $\displaystyle\int_{-\infty}^{\infty} u(t+1)u(4-t)dt$

(e) $\displaystyle\int_{-\infty}^{-4} \delta(\tau+3)d\tau$

PROBLEM s-05-Q.4.2:

In each of the following cases, determine the (inverse or forward) Fourier transform. Give your answer as a plot, or a $\boxed{\text{simple}}$ formula that is ***real-valued.***

$\boxed{\textbf{Explain}}$ each answer (briefly) by stating which property and/or transform pair you used.

(a) Find $x(t)$ when $X(j\omega) = \dfrac{12}{6 + j4\omega}$.

(b) Find $s(t)$ when $S(j\omega) = j50\sin(200\omega)$.

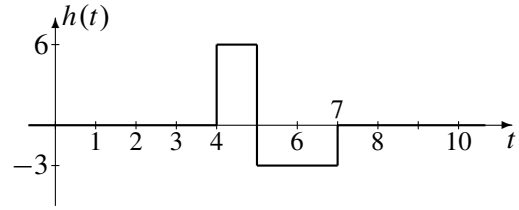
(c) Find $r(t)$ when $R(j\omega) = \pi^2\delta(\omega) + 13\pi\,\delta(\omega + 100\pi) + 13\pi\,\delta(\omega - 100\pi)$.

(d) Find $H(j\omega)$ when $h(t) = \delta(t) - \dfrac{\sin(6\pi t)}{\pi t}$.

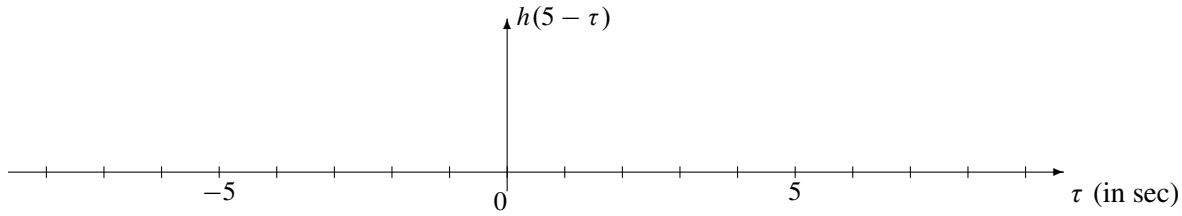
(e) Sketch the magnitude of $H(j\omega)$ obtained in the previous part, i.e., $|H(j\omega)|$ versus ω.

PROBLEM s-05-Q.4.3:

A linear time-invariant system has this impulse response:



(a) Plot $h(t-\tau)$ versus τ, for $t = 5$. Label your plot carefully.



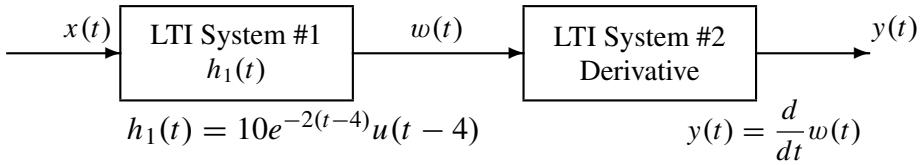
(b) If the input signal is the unit-step signal, $x(t) = u(t)$, use the convolution integral to find $y(5)$; i.e., the value of the output signal, $y(t) = x(t) * h(t)$, when $t = 5$.

(c) When the input signal is $x(t) = u(t)$ and the impulse response is $h(t)$ given above, it turns out that the output is **zero** for $t < T_1$ and for $t > T_2$. Find the values of T_1 and T_2. **Explain** your answers. *You may "flip and shift" either $x(t)$ or $h(t)$, whichever leads to the easiest explanation.*

$T_1 =$ ☐ $T_2 =$ ☐

PROBLEM s-05-Q.4.4:

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



(a) If the input to the first system is a sinusoid:

$$x(t) = 200\cos(2\,t)$$

Determine the output of the ***first system***, $w(t)$. Give your answer in the ***simplest possible form.***

(b) If the input to the first system is a shifted unit-step signal, $x(t) = u(t+4)$, determine the overall output signal, $y(t)$.