GEORGIA INSTITUTE OF TECHNOLOGY
School of Electrical Engineering

Quiz #1

Date: May 1, 1997 Course: EE 3230

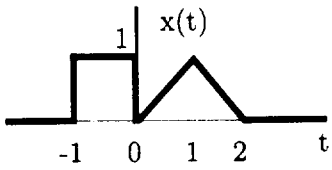
Name: _____
Last, First

- Closed book, closed notes, no calculators, one $8\frac{1}{2}'' \times 11''$ handwritten sheet is allowed. Eighty minute time limit.
- None of the problems require involved calculations. Reconsider your approach before doing something tedious.
- All work should be performed on the quiz itself. If more space is needed, use the backs of the pages.

| *Problem* | *Score* |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| Total | |

**Problem 1:**

Given $x(t)$ as drawn below, sketch and label each of the following signals.




(a) $y(t) = 3x\left(\frac{1-t}{4}\right)$

(b) $z(t) = \int_{-\infty}^{t} x(\tau)\delta\left(\tau + \frac{1}{2}\right) d\tau$

**Problem 2:**

Determine whether or not each of the following systems are memoryless, causal, stable, linear, and/or time-invariant. Fill each box below with either "Yes" or "No". (input = $x$; output = $y$)

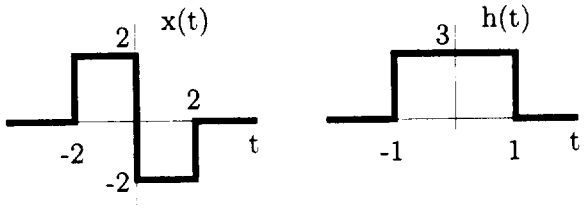
System I: $y(t) = x(u(t))$

System II: $y(t) = \int_{t-1}^{t+1} x(\tau/2)d\tau$

| | System I | System II |
|---|---|---|
| Memoryless | | |
| Causal | | |
| Stable | | |
| Linear | | |
| Time-Invariant | | |

**Problem 3:**

A linear, time-invariant system has the input $x(t)$ and impulse response $h(t)$ shown below.

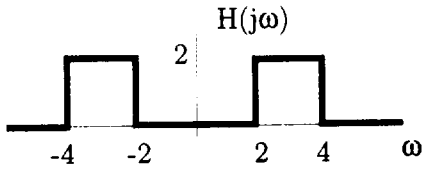



(a) The first step in finding the system output $y(t) = h(t) * x(t)$ by graphical convolution is to break $-\infty < t < \infty$ into sections. List all five regions (i.e., give $a < t < b$ for each region) that need to be considered for this problem.

(b) Find $y(t)$ for $t = -2$.

**Problem 4:**

A linear, time-invariant system has the frequency response




(a) This system's impulse response has the form $h(t) = a\cos(bt)\frac{\sin(ct)}{t}$. Find the constants $a$, $b$, and $c$.

(b) Find the output $y(t)$ when the system's input is $x(t) = 1 + \cos(\pi t)$. Simplify your answer as much as possible.

**Problem 5:**

Tell whether each of the following statements about linear, time-invariant (LTI) systems is true or false.

(a) An LTI system is stable if its impulse response is bounded.

(b) The inverse system of a causal, invertible LTI system is causal.

(c) If the impulse response of an LTI system is periodic and non-zero, the system is unstable.

(d) If $s(t)$ is the *step* response of an LTI system, and $s(t) = 0$, $t < 0$, the system is causal.

(e) If $h(t)$ is bounded for all $t$ and is zero for $t < T_1$ and for $t > T_2$, where $T_1$ and $T_2$ are both finite, the system is stable.