Name:_____

Section:_____

EE322 Fall 2008 Exam 2

Problem	Possible Points	Score
1	20	
2	20	
3	20	
4	20	
5	20	
Total	100	

- You will have the entire lab period (1 hr 50 min) to take this exam.
- You are allowed to use 1 page, single-side of notes or whatever you want to write on it, and a calculator, and the Table of Fourier transforms and properties that will be supplied to you.
- You ***must show your work*** to get full credit for problems. Expect to lose points if you don't.
- Label your sketches (axes and functions) carefully. Expect to lose points if you don't.

1. (20 pts) Given a system with impulse response $h[n] = 2 \cdot \text{ramp}[n] \cdot \left(u[n+3] - u[n-4]\right)$, <u>plot</u> the system output $y[n]$ when the input is $x[n] = 2u[n+1] - u[n-3]$.

2. (20 pts) The Fourier series Harmonic function for a certain signal $x(t)$ is given by: $X[k] = 4 + \delta[k-3] - 0.2j\delta[k+2] + \delta[k+3] + 0.2j\delta[k-2]$. The fundamental period of the signal is 0.01 sec. Determine the signal $x(t)$ and write it in terms of sinusoids.

a. What is the fundamental frequency in this problem?

b. Write $x(t)$ as a sum of complex exponentials.

c. Write $x(t)$ as a sum of sinusoids.

3. (20 pts) System Properties.

a. Prove whether or not the system defined by $y(t) = x(t) \cdot \cos\left(x(t)\right) \cdot \sin\left(x(t)\right)$ is time invariant or not.

b. Prove if the system defined by $y[n] = \left(x[n-1]\right)^2 + 2$ is linear or not.

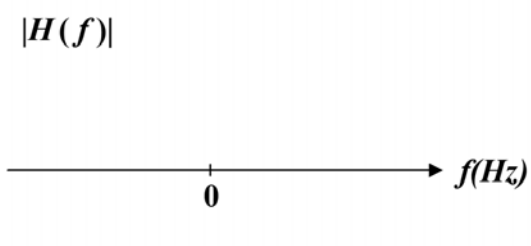
c. Is the system defined by $y(t) = x\left(t/3\right)$ causal? Why or why not?

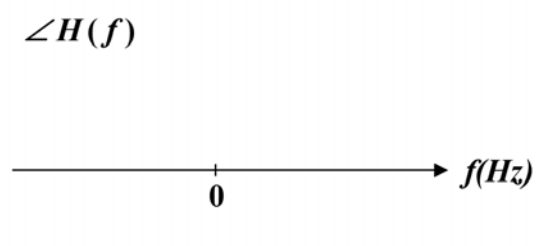
d. A system is defined by: $y[n] = x[n] + 0.3y[n-2]$. Find the impulse response $h[n]$ and prove whether the system is BIBO stable or not.

4. (20 pts total): Given a system with impulse response $h(t) = 2 \cdot \text{ramp}(-t) \cdot \text{rect}\left(t/4\right)$, using the continuous convolution integral, find the system output $y(t)$ when the input is $x(t) = \text{rect}\left(t/2\right)$. Write your answer in the form of equations for $y(t)$ for various values of time t.

5. (20 points total) A system's impulse response $h(t)$ has a Fourier transform given by: $H(f) = 2e^{-j4\pi f}$.

a. Sketch the magnitude and phase of $H(f)$ on the axes below. Clearly label your plots.





b. What is the impulse response of this system?

$h(t)$ = _____

c. Is this a causal system? Why or why not?