New Mexico State University
Klipsch School of Electrical Engineering

EE312 - Signals and Systems I
Fall 2015
Exam #1

Name: _____

Prob. 1	/ 25 points
Prob. 2	/ 25 points
Prob. 3	/ 25 points
Prob. 4	/ 25 points
Total	/ 100 points

Prob. 1

For the following problems, determine if $x(t)$ or $x[n]$ is periodic. Check the appropriate box and fill in other information as required. Determine the energy or power as directed.

(a) Let $x[n] = -15.7\cos(2n/3)$. Is $x[n]$ periodic?

☐ Yes, it is periodic and the period, $N =$ _____ .

☐ No, it is not periodic.

Compute the total energy, E over the time interval $0 \leq n \leq 2$ and average power, P over the time interval $0 \leq n \leq 2$.

(b) Let $x(t) = \begin{cases} t, & -1 \leq t \leq 1 \\ 0, & \text{otherwise} \end{cases}$. Is $x(t)$ periodic?

☐ Yes, it is periodic and the period, $T =$ _____ .

☐ No, it is not periodic.

Compute the total energy over the infinite time interval, E_∞ and average power over the infinite time interval, P_∞.

Prob. 2

For each of the following systems, check ✓the box if the system property is true and leave the box blank if the system property is false.

You do *not* need to provide a proof or argument to support your choice.

(a) Let $y(t) = x(t - 3.1) + 2.0$.

☐ BIBO STABLE

☐ CAUSAL

☐ LINEAR

☐ MEMORYLESS

☐ TIME INVARIANT

(b) Let $y[n] = (-1)^n x[n]$.

☐ BIBO STABLE

☐ CAUSAL

☐ LINEAR

☐ MEMORYLESS

☐ TIME INVARIANT

Prob. 2 (cont.)

(c) Let $y[n] = \sum_{k=0}^{\infty} x[n+k]$.

- ☐ BIBO STABLE
- ☐ CAUSAL
- ☐ LINEAR
- ☐ MEMORYLESS
- ☐ TIME INVARIANT

(d) Let the system be described by its impulse response, $h[n] = \left(\frac{1}{2}\right)^n u[-n]$.

- ☐ BIBO STABLE
- ☐ CAUSAL
- ☑ LINEAR
- ☐ MEMORYLESS
- ☑ TIME INVARIANT

(e) Let the system be described by its impulse response, $h(t) = e^t u(-t-1) + e^{-t} u(t-1)$.

- ☐ BIBO STABLE
- ☐ CAUSAL
- ☑ LINEAR
- ☐ MEMORYLESS
- ☑ TIME INVARIANT

Prob. 3

Consider the DT system

$$y[n] = x[n+1] + 2x[n] + x[n-1].$$

(a) Determine the output signal, $y[n]$ given the input signal, $x[n] = u[n] - u[n-5]$ for $-3 \leq n \leq 8$ and fill in the table below.

n	$y[n]$
-3	
-2	
-1	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

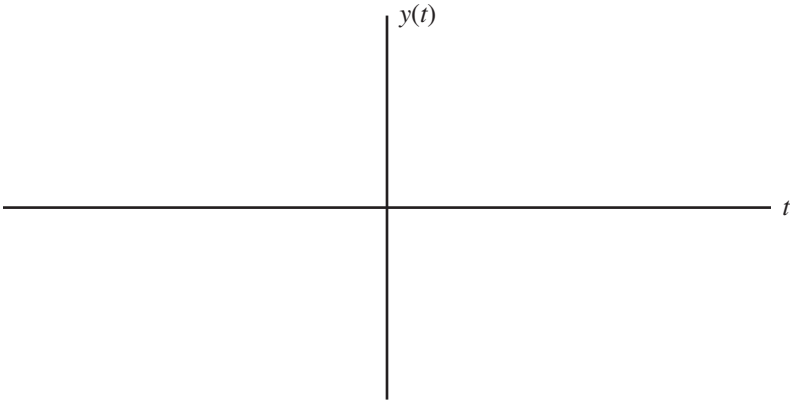
(b) Determine the impulse response, $h[n]$ for the system.

Prob. 4

For the following systems characterized by their impulse response $h(t),\ h[n]$ determine the output signal $y(t),\ y[n]$ for the given input signal $x(t),\ x[n]$ respectively by explicit convolution (graphical or analytical). *Carefully* graph the output (be sure to label critical x- and y-values).

(a) Let $h(t) = u(t) - u(t-2) + \delta(t-4)$ and $x(t) = u(t) - u(t-1)$. $y(t) = ?$

Hint: Separate $h(t)$ into $h_1(t) = u(t) - u(t-2)$ and $h_2(t) = \delta(t-4)$ connected in parallel. Then use p. 105 Figure 2.23(a) to find $y(t)$.



Prob. 4 (cont.)

(b) Let $h[n] = \delta[n+1] + 2\delta[n] + \delta[n-1]$ and $x[n] = u[n] - u[n-5]$. $y[n] = ?$