New Mexico State University
Klipsch School of Electrical Engineering

EE312 - Signals and Systems I
Fall 2016
Exam #1

Name: _____

Prob. 1	/ 25 points
Prob. 2	/ 25 points
Prob. 3	/ 15 points
Prob. 4	/ 35 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. Please see the footnote for parts (b) and (c).

(a) Let $x(t) = e^{j2(t+\pi/10)} + e^{j3(t+\pi/12)}$. Is $x(t)$ periodic?

☐ Yes, it is periodic and the fundamental frequency, $\omega_0 =$ _____ .

☐ No, it is not periodic.

☐ Maybe: (fill in one of these)

It is periodic if _____ but otherwise it is not periodic.

It is not periodic if _____ but otherwise it is periodic.

(b) Let $x[n] = e^{j2n/3} + e^{j3\pi n/4}$. Is $x[n]$ periodic?

☐ Yes, it is periodic and the fundamental frequency[1], $\omega_0 =$ _____ .

☐ No, it is not periodic.

☐ Maybe: (fill in one of these)

It is periodic if _____ but otherwise it is not periodic.

It is not periodic if _____ but otherwise it is periodic.

(c) Let $x[n] = \cos(16\pi n/3)$. Is $x[n]$ periodic?

☐ Yes, it is periodic and the fundamental frequency[1], $\omega_0 =$ _____ .

☐ No, it is not periodic.

☐ Maybe: (fill in one of these)

It is periodic if _____ but otherwise it is not periodic.

It is not periodic if _____ but otherwise it is periodic.

[1] Use the interval $0 \leq \omega_0 < 2\pi$ as per p. 26 of text.

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.

Provide a proof, counter-example, or reason to support your choice where denoted.

(a) Let the system be described by its impulse response, $h[n] = u[n+10] - u[n-10]$.

☐ BIBO STABLE

☑ LINEAR

☐ MEMORYLESS

☑ TIME INVARIANT

☐ CAUSAL (Provide proof, counter-example, or reason)

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

☐ CAUSAL

☑ LINEAR

☐ MEMORYLESS

☑ TIME INVARIANT

☐ BIBO STABLE (Provide proof, counter-example, or reason)

Prob. 2 (cont.)

(c) Let $y(t) = x(1/t)$.

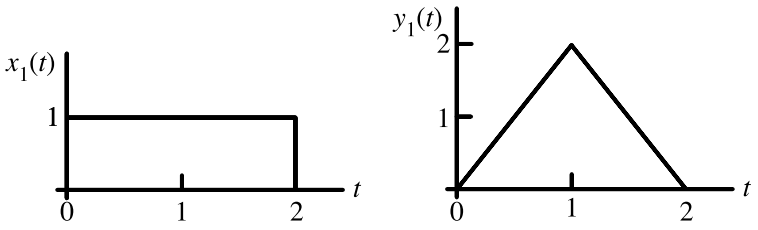
- ☐ BIBO STABLE
- ☐ LINEAR
- ☐ MEMORYLESS
- ☐ TIME INVARIANT
- ☐ CAUSAL (Provide a proof or counter-example)

(d) Let $y[n] = 1/x[n]$.

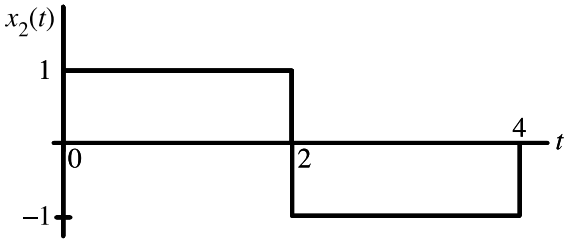
- ☐ BIBO STABLE
- ☐ CAUSAL
- ☐ LINEAR
- ☐ MEMORYLESS
- ☐ TIME INVARIANT (Provide a proof or counter-example)

Prob. 3

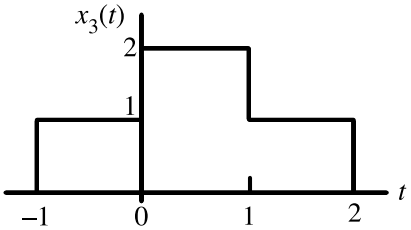
Consider an LTI system whose response to the signal $x_1(t)$ (shown below) is the signal $y_1(t)$ (shown below).



(a) Determine and plot the response of the system to the signal $x_2(t)$.



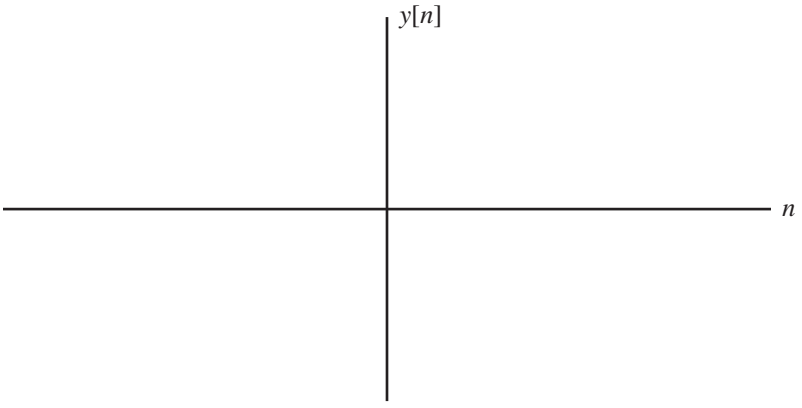
(b) Determine and plot the response of the system to the signal $x_3(t)$.



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 $h[n] = \left(\frac{1}{2}\right)^{-n} \{u[n] - u[n-10]\}$ and $x[n] = \delta[n+1] + \delta[n-1]$. $y[n] = ?$



Prob. 4 (cont.)

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