LINEAR SYSTEMS AND CIRCUIT APPLICATIONS Surname: _____

BIOMEDICAL ENGINEERING

Part I - Linear Systems Name: _____

19th November 2018

1. [2 puntos] Let be the following signals:

$$x(t) = \sum_{k=-\infty}^{+\infty} u(t-3k) - u(t-1-3k)$$

$$z(t) = x(t) \cdot [t \cdot (u(t+1) - u(t-1))]$$

$$y(t) = \frac{dx(t)}{dt} + z(-3t+2) - 1$$

(a) [0.5 puntos] Sketch the signal $x(t)$ and study the symmetry.

(b) [0.5 puntos] Study the periodicity of $x(t)$. Find the average value, total power and energy.

(c) [1 puntos] Sketch and provide with an analytical expression for $y(t)$.

2. [2 puntos] Let be the following systems:

(a) [0.5 puntos] Study the linearity and invariance of the following system:

$$y(t) = 3\delta(1-t) + \int_t^{\infty} x(\tau-2)e^{-t2\tau}d\tau$$

(b) [0.5 puntos] Study causality and stability of the following LITS whose impulse response is:

$$h(t) = \left(\frac{1}{5}\right)^{-t} u(1+t)$$

(c) [0.5 puntos] Let be an LTIS whose input-output relationship is given by:

$$y(t) = \int_{-\infty}^{t} e^{-(t-\tau)}x(\tau-5)d\tau$$

Find the impulse response $h(t)$.

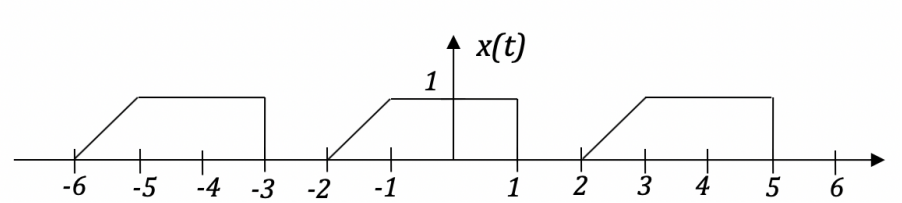
(d) [0.5 puntos] Find the output signal, in the previous system, when the input is

$$x(t) = \frac{1}{3}[u(t+1) - u(t-2)]$$

3. [2 puntos] Find the Fourier Series of the following signal:

$$x(t) = \sum_{k=-\infty}^{+\infty} 2\delta(t-1-4k) + 3e^{j\left(\frac{\pi}{2}t+\frac{\pi}{3}\right)}$$

4. [2 puntos] Find the Fourier Series of the following signal:



5. [2 puntos] Find the Fourier Transform of the following signal:

$$x(t) = \frac{\omega_1}{2\pi}\text{sinc}^2\left(\frac{\omega_1}{2\pi}t\right)$$