Homework # 3   EE Signals and Linear Systems

1.- Demonstrate that the assertions below are correct.

◻ Time-Invariant   Not Time-Invariant

(a) $y_1(t) = 3\,\dfrac{d^2 x}{dt^2}$,

(b) $y_2(t) = \sin[x(t)]$

(c) $y_3(t) = \dfrac{x(t+2)}{x(t-1)}$

(d) $y_4(t) = t\,x(t)$,

(e) $y_5(t) = x(t^2)$,

(f) $y_6(t) = x(-t)$.

Note1: Systems b and c are time-invariant, but not linear.

Note2: Systems d to f are linear, but not time-invariant.

2. -

2.14 Functions $x(t)$ and $h(t)$ are given by

$$x(t) = \begin{cases} 0, & \text{for } t < 0 \\ \sin \pi t, & \text{for } 0 \le t \le 1 \text{ s} \\ 0, & \text{for } t \ge 1 \text{ s} \end{cases}$$

$$h(t) = u(t).$$

Determine $y(t) = x(t) * h(t)$.

3.-

2.16 Compute the following convolutions *without computing any integrals.*

(a) $\delta(t-2) * [u(t) - 3u(t-1) + 2u(t-2)]$
(b) $[\delta(t) + 2\delta(t-1) + 3\delta(t-2)] * [4\delta(t) + 5\delta(t-1)]$
(c) $u(t) * [u(t) - u(t-2) - 2\delta(t-2)]$

4.-

2.17 Compute the following convolutions.

*(a) $e^{-t} u(t) * e^{-2t} u(t)$
(b) $e^{-2t} u(t) * e^{-3t} u(t)$
(c) $e^{-3t} u(t) * e^{-3t} u(t)$