Extra points - Midterm

(Due Date: July 18th @ 2pm)
Presentation is very important!

PROBLEM 1 (4 PTS)

Evaluate the convolution for the following cases:

a) $x[n] = e^{n} u[-n+4]$ $\quad h[n] = e^{-2n} (u[n-1] - u[n+1])$
b) $x[n] = \sin(\pi n) u[n]$ $\quad h[n] = u[n-1]$
c) $x(t) = \cos(\pi t)(u(t+1) - u(t-1))$ $\quad h(t) = \sin(\pi t)(u(t+1) - u(t-3))$
d) $x(t) = e^{-3t} (u(t+1) - u(t-2))$ $\quad h(t) = \sin(3t)(u(t-2) - u(t+2))$

PROBLEM 2 (6 PTS)

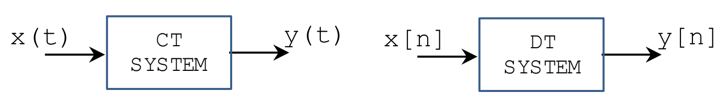
Identify the appropriate Fourier representation (FT, DTFT, FS, DTFS) for each of the following signals. If the signals are periodic, provide the fundamental period and the fundamental angular frequency. Also, specify (if applicable) the period of the Fourier representation.

a) $x(t) = \cos((\pi/3)t) + \sin((\pi/4)t)$
b) $x(t) = \sin((\pi/5)t)\times\sin((\pi/7)t)$
c) $x(t) = t\times\cos((\pi/3)t + \pi/5)$
d) $x[n] = \cos(n/6 + \pi/4)$
e) $x[n] = j\cos((\pi/5)n) + \sin((\pi/5)n)$
f) $x[n] = e^{-2n} \delta[n+3] + \delta[n-7] + e^{-5n} \delta[n-5] + \delta[n-4]$.

Once you identified the appropriate Fourier representation, use the defining equation (or the inspection method) to obtain the DTFS coefficients, the FS coefficients, the DTFT, or the FT.

PROBLEM 3 (5 PTS)

The systems that follow have input $x(t)$ or $x[n]$ and output $y(t)$ or $y[n]$ respectively. For each system, determine (and justify) whether it is (i) memoryless, (ii) stable, (iii) causal, (iv) linear, and (v) time invariant. Recall that to disprove that a system has a certain property, all you need is to come up with a counter-example.



a) $y(t) = x(2t) - cos(2x(3t))$

b) $y(t) = log_4(|x(t-1)|)$

c) $y[n] = e^{-n}x[n-2]u[n]$

d) $y[n] = h[n] * x[n]$, where $*$ denotes convolution, and $h[n] = e^{-2n}u[n+1] + e^{-4n}u[n-2]$

e) $y[n] = x[n] + n^5 x[n-1] + x[n+1]$