UEC-404 Signals & Systems

Tutorial #7

[1] **Determine and sketch the convolution of the following two signals:**

$$x(t) = \begin{cases} t+1 & 0 \le t \le 1 \\ 2-t & 1 < t \le 2 \\ 0 & elsewhere \end{cases}$$

and $h(t) = \delta(t+2) + 2\delta(t+1)$

[2] **Compute the output** $y(t)$ **for a continuous time LTI system whose impulse response** $h(t)$ **and the input** $x(t)$ **is given by** $h(t) = e^{-\alpha t}\, u(t)$ **and** $x(t) = e^{\alpha t}\, u(-t)$, $\alpha > 0$

[3] **Find the convolution sum of a rectangle signal (or gate function) with itself.**

$$x[n] = rect\left[\frac{n}{2N}\right] = \Pi\left[\frac{n}{2N}\right] = \begin{cases} 1, & -N \le n \le N \\ 0, & otherwise \end{cases}$$

[4]

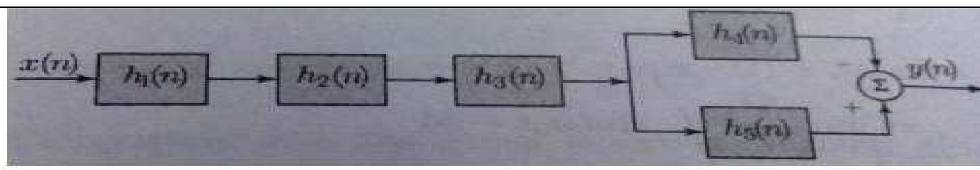

Fig.1

Determine the overall impulse response of the system shown in Fig. 1 Given that

$h_1[n] = \delta[n] - a\delta[n-1]$

$h_2[n] = \left[\frac{1}{2}\right]^n u[n]$

$h_3[n] = a^n\, u[n]$

$h_4[n] = [n-1]u[n]$

$h_5[n] = \delta[n] + nu[n-1] + \delta[n-2]$

[5] **Consider the periodic square wave x(t) shown in Fig.2**

Determine the complex exponential Fourier series of $x(t)$

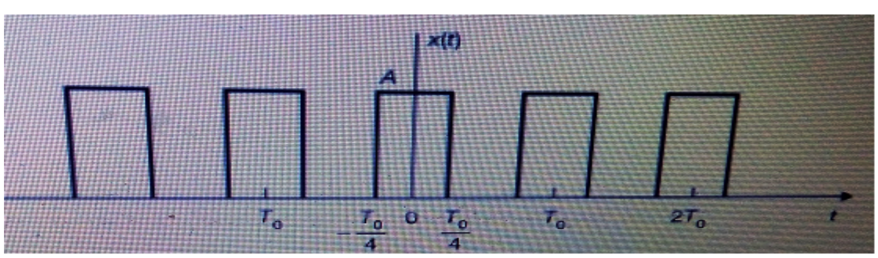

Fig.2

[6]	**Suppose we are given the following information about a signal $x(t)$:** **i) $x(t)$ is real and odd.** **ii) $x(t)$ is periodic with period $T = 2$ and has Fourier coefficients a_k** **iii) $a_k = 0$ for $\|k\| > 1$** **iV) $\frac{1}{2}\int_0^2 \|x(t)\|^2\,dt = 1$**
[7]	**Discuss and derive the differentiation and integration properties in complex exponential Fourier series.**