PARCIAL 1

$$h[n] = e^{-|n|} = \begin{cases} e^{-n} & n \geq 0 \\ e^{n} & n < 0 \end{cases} \qquad x[n] = \begin{cases} 2^n & 5 \leq n \leq 10 \\ 0 & \text{resto} \end{cases}$$

a) $$P_i[n] = |x[n]|^2 = \begin{cases} 4^n & 5 \leq n \leq 10 \\ 0 & \text{resto} \end{cases} \qquad x_p = x[10] = 2^{10}$$

$$E = \sum_{n=-\infty}^{\infty} |x[n]|^2 = \sum_{n=5}^{10} 4^n = \frac{4^5 - 4^{11}}{1-4}$$

$P_{AV} = 0$ (POR SER SEÑAL DE ENERGÍA)

c) Con memoria $h[n] \neq C \cdot \delta[n]$

No causal $h[n]$ toma valores para $n > 0$ y $n < 0$

ESTABILIDAD:

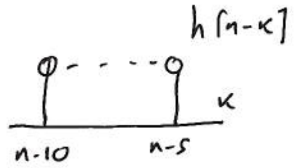
$$\sum_{n=-\infty}^{\infty} |e^{-|n|}| = \sum_{n=-\infty}^{-1} e^{n} + \sum_{n=0}^{\infty} \left(\frac{1}{e}\right)^n$$

$$= \sum_{n=1}^{\infty} \left(\frac{1}{e}\right)^n + \sum_{n=0}^{\infty} \left(\frac{1}{e}\right)^n$$

$$= \frac{1/e}{1-\frac{1}{e}} + \frac{1}{1-1/e} = \frac{e+1}{e-1} < \infty$$

SISTEMA ESTABLE

d) $$y[n] = \sum_{k=-\infty}^{-1} e^{k}\, h[n-k] + \sum_{k=0}^{\infty} \left(\frac{1}{e}\right)^k h[n-k]$$



$n < 5$ $$\sum_{k=n-10}^{n-5} e^{k}\, 2^{n-k} = y[n]$$

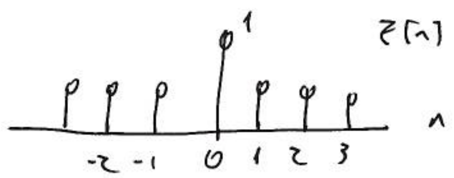
$5 \leq n \leq 9$ $$\sum_{k=n-10}^{-1} e^{k}\, 2^{n-k} + \sum_{k=0}^{n-5} \left(\frac{1}{e}\right)^k 2^{n-k}$$

$n > 9$ $$\sum_{k=n-10}^{n-5} \left(\frac{1}{e}\right)^k 2^{n-k}$$

$$y[n] = \begin{cases} 2^n \dfrac{\left[\left(\frac{e}{2}\right)^{n-10} - \left(\frac{e}{2}\right)^{n-4}\right]}{1 - e/2} & n < 5 \\[2ex] 2^n \dfrac{\left(\frac{e}{2}\right)^{n-10} - 1}{1 - e/2} + 2^n \dfrac{1 - \left(\frac{1}{2e}\right)^{n-4}}{1 - \frac{1}{2e}} & 5 \leq n \leq 9 \\[2ex] 2^n \dfrac{\left(\frac{1}{2e}\right)^{n-10} - \left(\frac{1}{2e}\right)^{n-4}}{1 - \frac{1}{2e}} & n > 9 \end{cases}$$

e) $z[n] = Ev\{u[n]\} \longrightarrow e^{j20\pi \cdot n} = 1$

$z[n] = \dfrac{u[n] + u[-n]}{2} \rightarrow$



No Periódica

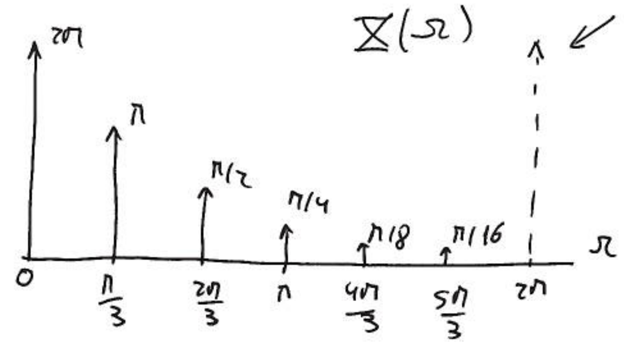
PARCIAL 2

a) $$x[n] = \sum_{k=\langle N\rangle} c_k \, e^{jk\frac{2\pi}{6}n} = \sum_{k=0}^{5} \left(\frac{1}{2}\right)^k e^{jk\frac{2\pi}{6}n}$$

$$X(\Omega) = \sum_{k=0}^{5} \left(\frac{1}{2}\right)^k \cdot 2\pi \cdot \delta_p\left(\Omega - k\frac{\pi}{3}\right)$$

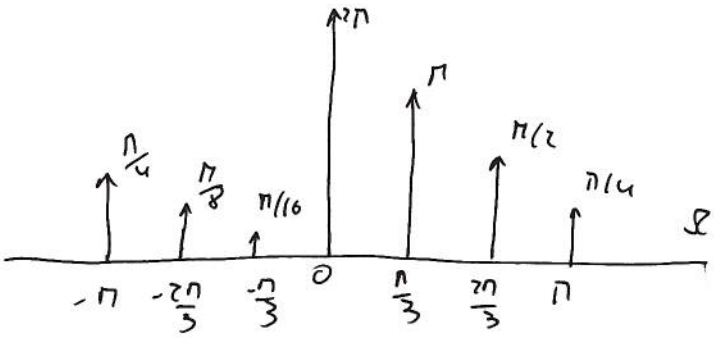
↳ La delta es periódica

DIBUJAMOS:



En 2π se duplica la delta de Ω = φ

PARA PASAR A [-π, π], ASUMIMOS PERIODICIDAD



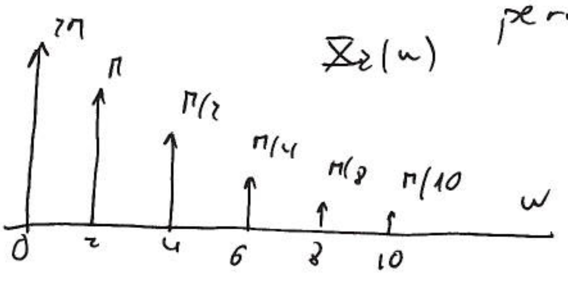
b) Por ser señal periódica, señal de POTENCIA

$$E = \infty$$

$$P = \frac{1}{N} \sum_{k=\langle N\rangle} |x[n]|^2 \underset{\substack{\uparrow \\ \text{PARSEVAL}}}{=} \sum_{k=\langle N\rangle} |a_k|^2 = \sum_{k=0}^{5} \left(\frac{1}{4}\right)^k = \frac{1-(1/4)^6}{1-1/4}$$

c) $$X_2(w) = \sum_{k=0}^{5} \left(\frac{1}{2}\right)^k \cdot 2\pi \, \delta(w - 2k)$$

↳ En este caso, la $\delta(n)$ no es periódica



d)

$$Y(\omega)(2+j\omega) = 3X(\omega)$$

$$H(\omega) = \frac{Y(\omega)}{X(\omega)} = \frac{3}{2+j\omega}$$

$$h(t) = 3\cdot e^{-t}u(t)$$

e) Podemos escribir:

$$x(t) = e^{j2\pi t} - e^{-j2\pi t} + e^{j\phi}e^{j3t} + e^{-j\phi}e^{-j3t}$$

Y aplicando que $e^{j\omega_0 t} \longrightarrow \boxed{LTI} \longrightarrow H(\omega_0)e^{j\omega_0 t}$

$$y(t) = H(2\pi)e^{j2\pi t} - H(-2\pi)e^{-j2\pi t} + e^{j\phi}H(3)e^{j3t} + e^{-j\phi}H(-3)e^{-j3t}$$

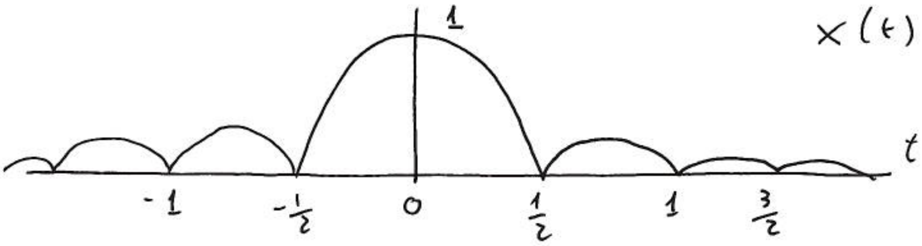
$$y(t) = \frac{3}{2+j2\pi}e^{j2\pi t} - \frac{3}{2-j2\pi}e^{-j2\pi t} + \frac{3e^{j\phi}}{2+j3}e^{j3t}$$

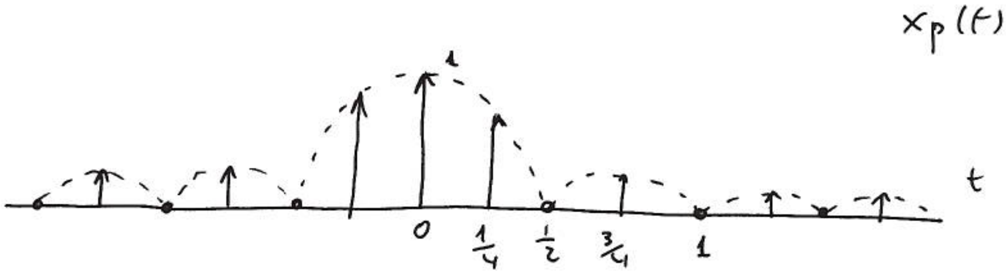
$$+\frac{3e^{-j\phi}}{2-j3}e^{-j3t}$$

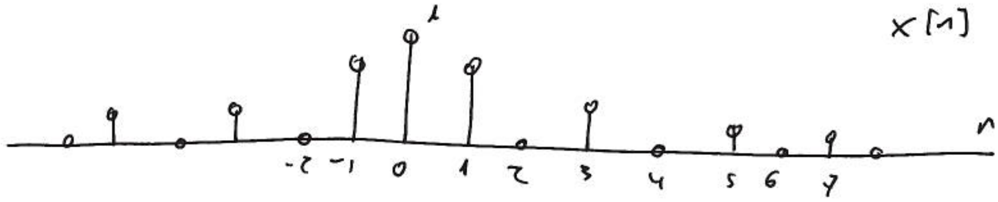
PARCIAL 3

a) $x(t) = \left(\mathrm{sinc}(2t) \right)^2$ $\qquad T = \frac{1}{4}$

TIEMPO

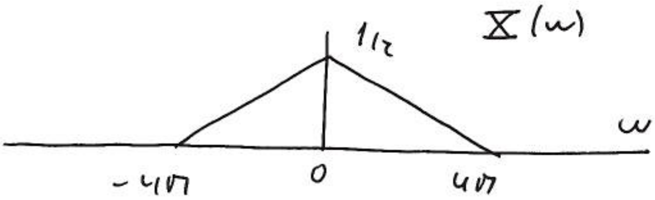


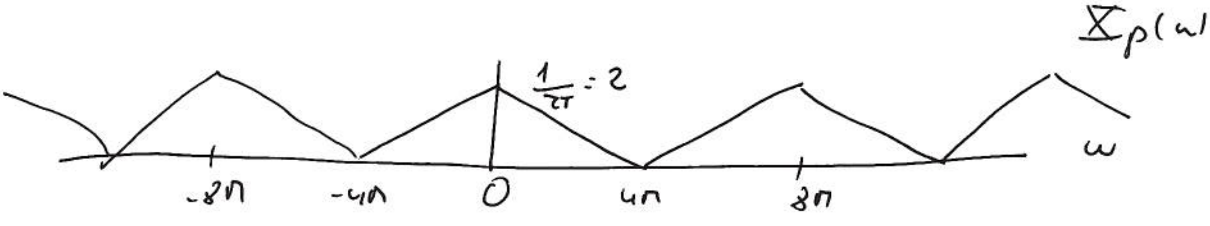


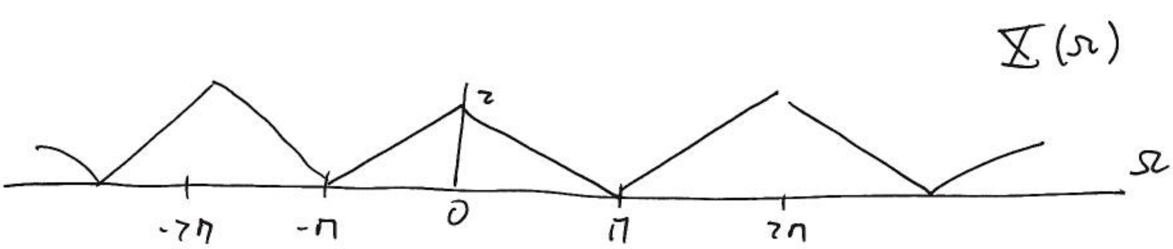


FRECUENCIA

$\omega_s = 2\omega_M$ (NYQUIST)
$= 8\pi$



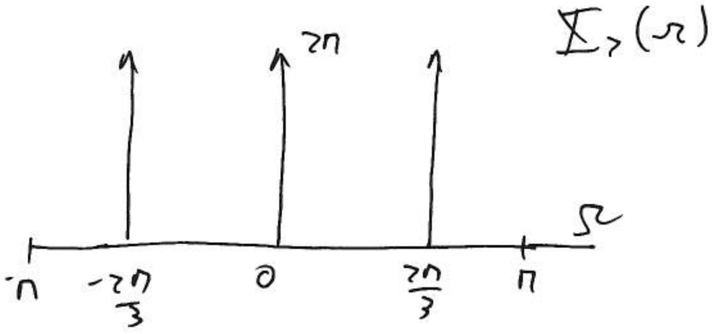




b) $x_2[n] = \sum_{k=\langle N \rangle} e^{jk\frac{2\pi}{3}n}$

$$X_2(\Omega) = \sum_{k=\langle N \rangle} 2\pi \cdot \delta_p\left(\Omega - k\frac{2\pi}{3}\right)$$

DIBUJO ENTRE $(-\pi, \pi]$

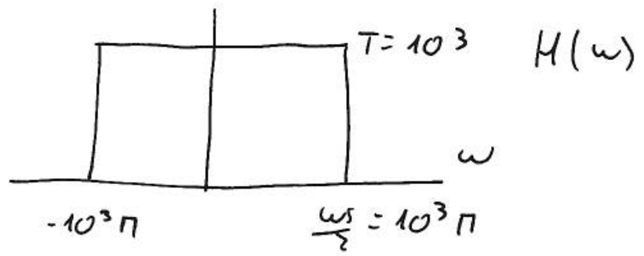


EL ESQUEMA DE RECONSTRUCCIÓN

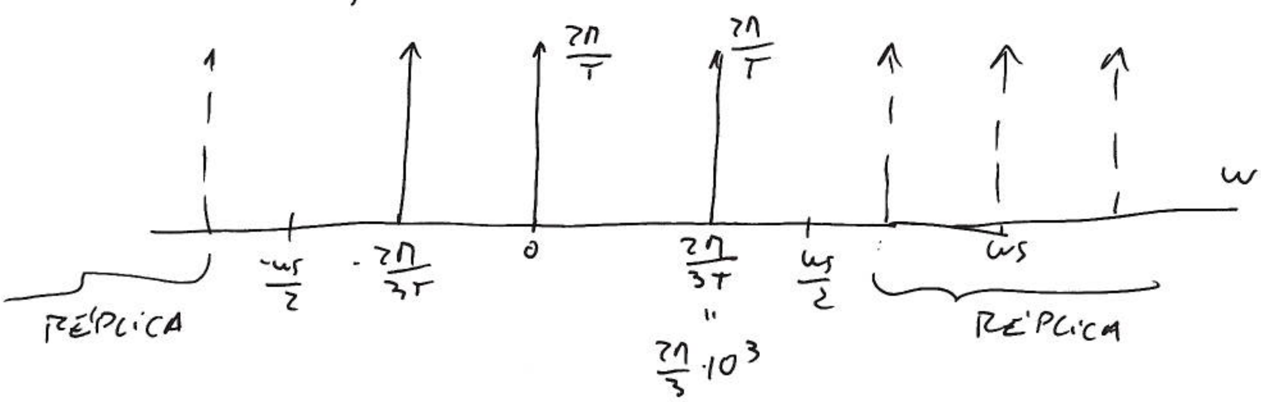
$$x_2[n] \to \boxed{D/C} \to x_p(t) \to \boxed{LPF} \to x_2(t)$$

$G = T$
$\omega_c = \frac{\omega_s}{2}$

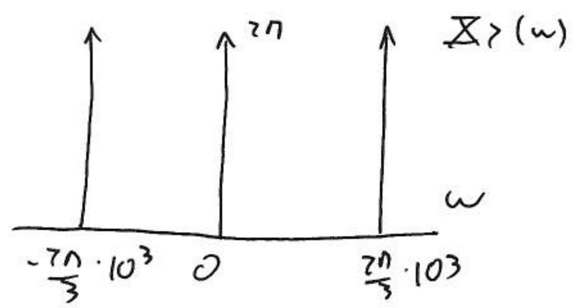
EL FILTRO:



La señal $X_p(\omega)$ será



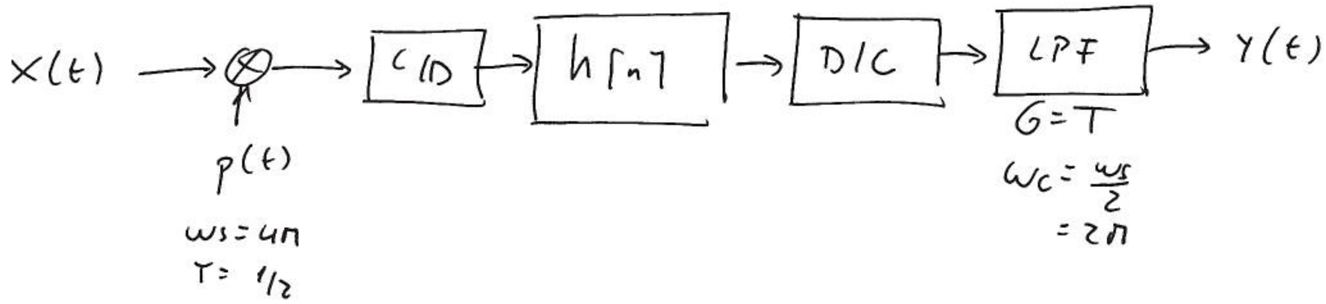
Y AL FILTRAR



AL CALCULAR LA INVERSA

$$x_2(t) = 1 + 2\cos\left(\frac{2\pi}{3} 10^3 t\right)$$

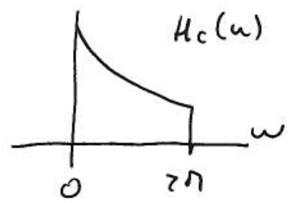
c) EL ESQUEMA PROPUESTO ES



h[n] lo definimos como:

① LIMITO $H_c(\omega)$ en banda

$$H_c(\omega) = \begin{cases} e^{-\omega} & 0 < \omega < \frac{\omega_s}{2} = 2\pi \\ 0 & \text{resto} \end{cases}$$



② CAMBIO DE VARIABLE

$$H_D(\Omega) = H_c\left(\frac{\Omega}{T}\right) = \begin{cases} e^{-2\Omega} & 0 < \Omega < \pi \\ 0 & -\pi < \Omega < 0 \end{cases}$$

$$h[n] = \frac{1}{2\pi}\int_0^{\pi} e^{-2\Omega} e^{j\Omega n}\, d\Omega = \frac{e^{jn\pi} e^{-2\pi} - 1}{jn - 2}$$

$$\boxed{h[n] = \frac{e^{-2\pi}(-1)^n - 1}{jn - 2}}$$