FILA B

Es. 1

$$x_0(t) = \left(1 - \frac{|t|}{\frac{1}{4B}}\right) \operatorname{rect}\left(\frac{t}{\frac{1}{2B}}\right)$$

$$X_0(f) = \frac{1}{4B}\, mc^2 \left(\frac{f}{4B}\right)$$

$$X(f) = \frac{B}{2} \sum_k X_0\left(\frac{k}{T_0}\right) \delta\left(f - \frac{k}{T_0}\right) =$$

$$= \frac{B}{2} \sum_k \frac{1}{4B}\, mc^2 \left(k \frac{B}{2} \frac{1}{4B}\right) \delta\left(f - k\frac{B}{2}\right) =$$

$$= \frac{1}{8} \sum_k mc^2 \left(\frac{k}{8}\right) \delta\left(f - k\frac{B}{2}\right)$$

$$H(f) = \left(1 - \frac{|f|}{B}\right) \operatorname{rect}\left(\frac{f}{2B}\right)$$

Dal filtro vanno solo le componenti per $k = 0, \pm 1$

$$X_0 = \frac{1}{8} \qquad X_1 = \frac{1}{8}\, mc^2 \left(\frac{1}{8}\right) = X_{-1}$$

$$Y(f) = \frac{1}{8}\delta(f) + \frac{1}{2} \cdot \frac{1}{8}\, mc^2 \left(\frac{1}{8}\right) \left(\delta\left(f - \frac{B}{2}\right) + \delta\left(f + \frac{B}{2}\right)\right) =$$

$$= \frac{1}{8} + \frac{1}{8}\, mc^2 \left(\frac{1}{8}\right) \left(\delta\left(f - \frac{B}{2}\right) + \delta\left(f + \frac{B}{2}\right)\right)$$

$$P_y = \frac{1}{64} + 2 \cdot \left(\frac{1}{8}\, mc^2 \left(\frac{1}{8}\right)\right)^2 \qquad E_y = \infty$$

ES. 2

$$x(t) = 2\,\mathrm{sinc}(2Bt)\,\sin\left(2\pi Bt + \frac{\pi}{6}\right)$$

$$X(f) = \frac{1}{2B}\,\mathrm{rect}\left(\frac{f}{2B}\right) \otimes \left(\frac{1}{j}\,\delta(f-B)\,e^{j\frac{\pi}{6}} - \frac{1}{j}\,\delta(f+B)\,e^{-j\frac{\pi}{6}}\right) =$$

$$= \frac{1}{2B}\,\mathrm{rect}\left(\frac{f}{2B}\right) \otimes \left(\delta(f-B)\,e^{j\frac{\pi}{6}}\,e^{-j\frac{\pi}{2}} - \delta(f+B)\,e^{-j\frac{\pi}{6}}\,e^{-j\frac{\pi}{2}}\right) =$$

$$= \frac{1}{2B}\,\mathrm{rect}\left(\frac{f-B}{2B}\right) e^{-j\frac{\pi}{3}} + \frac{1}{2B}\,\mathrm{rect}\left(\frac{f+B}{2B}\right) e^{+j\frac{\pi}{3}}$$

$$Y(f) = 2\,\mathrm{rect}\left(\frac{f-B/4}{B/2}\right) e^{-j\pi/3} + 2\,\mathrm{rect}\left(\frac{f+B/4}{B/2}\right) e^{+j\pi/3}$$

$$y(t) = 2B\,\mathrm{sinc}\left(\frac{B}{2}t\right)\cos\left(2\pi\frac{B}{4}t - \frac{\pi}{3}\right)$$

$$E_y = 4B \qquad P_y = 0$$

ES. 3

$$T[\cdot] = \int_{a}^{t-t_1} x(\alpha)\,d\alpha = y(t)$$

LINEARE sì

$$T\left[c_1 x_1(t) + c_2 x_2(t)\right] = \int_{a}^{t-t_1} c_1 x_1(\alpha) + c_2 x_2(\alpha)\,d\alpha =$$

$$= c_1 \int_{a}^{t-t_1} x_1(\alpha)\,d\alpha + c_2 \int_{a}^{t-t_1} x_2(\alpha)\,d\alpha$$

CAUSALE sì

l'uscita a t dipende solo da valori passati

CON MEMORIA SI

l'uscita a t dipende da infiniti valori

STAZIONARIO NO

$$T[x(t-t_0)] = \int_a^{b-t_1} x(\alpha - t_0) \overset{\beta = \alpha - t_0}{=} \int_{a-t_0}^{t-t_1-t_0} x(\beta)\, d\beta \neq$$

$$y(t-t_0) = \int_a^{t-t_1-t_0} x(\alpha)\, d\alpha$$