FILA C

Es. 1

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

$$x(t) = \sum_n x_0(t - nT_0)$$

$$T_0 = \frac{2}{B}$$

$$X_0(f) = \frac{1}{2B}\,\text{sinc}\left(\frac{f}{2B}\right) - \frac{1}{2B}\,\text{sinc}^2\left(\frac{f}{2B}\right)$$

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

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

Dal filtro posso selezionare le componenti per $k = 0, \pm 1$

$$X_0 = \frac{B}{2}\left(\frac{1}{2B} - \frac{1}{2B}\right) = 0$$

$$X_1 = \frac{B}{2}\left(\frac{1}{2B}\,\frac{\text{sin}\left(\frac{\pi}{2}\right)}{\frac{\pi}{4}} - \frac{1}{2B}\,\frac{\text{sin}^2\left(\frac{\pi}{2}\right)}{\left(\frac{\pi}{4}\right)^2}\right) = \frac{1}{4}\left(\frac{2\sqrt{2}}{\pi} - \frac{8}{\pi^2}\right) = X_{-1}$$

$$Y(f) = \frac{1}{2}\cdot\frac{1}{4}\left(\frac{2\sqrt{2}}{\pi} - \frac{8}{\pi^2}\right)\left(\delta\left(f - \frac{B}{2}\right) + \delta\left(f + \frac{B}{2}\right)\right)$$

$$y(t) = \frac{1}{4}\left(\frac{2\sqrt{2}}{\pi} - \frac{8}{\pi^2}\right)\cos\left(2\pi\frac{B}{2}t\right)$$

$$P_y = 2\cdot|X_1|^2 = \frac{1}{8\pi^2}\left(\sqrt{2} - \frac{4}{\pi}\right)^2 \qquad E_y = \infty$$

ES. 2

$$x(t) = 2\,\mathrm{sinc}(2Bt)\cos\left(2\pi B t + \frac{2}{3}\pi\right)$$

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

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

$$P(f) = \mathrm{rect}\left(\frac{f}{B}\right)$$

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

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

$$E_y = \infty \qquad P_y = 0$$

ES. 3

VEDI SOL. FILA A.