Sol. 21 Aprile 2017 Es. 2

1) $E_s = \frac{1}{2}\left[E[x_c^2] + E[x_s^2] \right] E_p$

$E[x_c^2] = \frac{1}{2}(-1)^2 + \frac{1}{2}(2)^2 = \frac{5}{2}$

$E[x_s^2] = \frac{1}{2}(-2)^2 + \frac{1}{2}(1)^2 = \frac{5}{2}$

$P(f) = T \,\mathrm{rect}\left(\frac{T}{2} f\right)$

$E_p = \int_{-\infty}^{+\infty} P^2(f)\, df = T^2 \cdot \frac{2}{T} = 2T$

$$\boxed{E_s = \frac{1}{2}\left(\frac{5}{2} + \frac{5}{2}\right) 2T = 5T}$$

2) $P_{n_{uc}} = N_0 \int_{-\infty}^{+\infty} |H_R(f)|^2\, df = \frac{2N_0}{3T}$

$$\boxed{P_{n_{us}} = P_{n_{uc}} = \frac{2N_0}{3T}}$$

3) Verif. cond. Nyquist

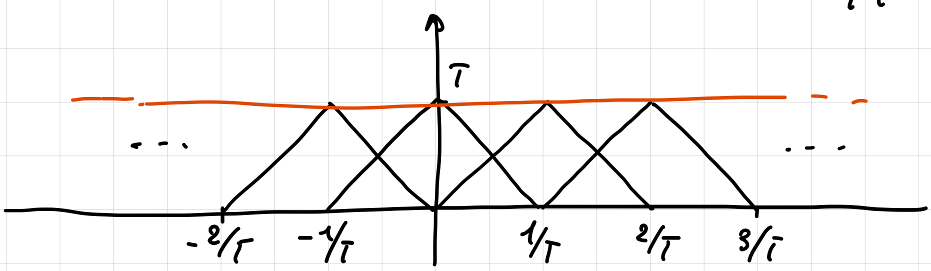
$h(t) = p(t) \otimes c(t) \otimes h_R(t)$

$c(t) = \delta(t)$

$h(t) = p(t) \otimes h_R(t) \iff H(f) = P(f)\,H_R(f) = T\,H_R(f)$

$\sum_n H\left(f - \frac{n}{T}\right) = T$

sodd. la cond. di Nyquist $\Rightarrow$ NO ISI



$$h(0) = \int_{-\infty}^{+\infty} H(f)\, df = 1$$

$$P_E(n) = P_{E_C}(b)\, P_{E_S}(b) + P_{E_C}(b)\left(1 - P_{E_S}(b)\right) + $$
$$+ P_{E_S}(b)\left(1 - P_{E_C}(b)\right)$$

$$P_{E_C}(b) = \frac{1}{2}\, Q\left(\frac{1}{\sqrt{\frac{2N_0}{3T}}}\right) + \frac{1}{2}\, Q\left(\frac{2}{\sqrt{\frac{2N_0}{3T}}}\right)$$

$$P_{E_S}(b) = \frac{1}{2}\, Q\left(\frac{2}{\sqrt{\frac{2N_0}{3T}}}\right) + \frac{1}{2}\, Q\left(\frac{1}{\sqrt{\frac{2N_0}{3T}}}\right)$$