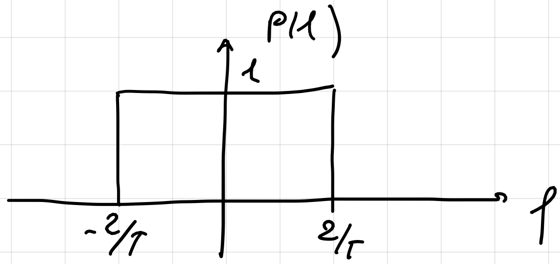
Sol. Es. 2 Giugno 2017

1) $E_s = A_o^2 \, E[x^2] \, E_p = A_o^2 \cdot 1 \cdot \frac{4}{T} = \boxed{\frac{4A_o^2}{T}}$

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

$E_p = \int_{-\infty}^{+\infty} |P(f)|^2 df = \frac{4}{T}$

$P(f) = \text{rect}\left(\frac{fT}{4}\right)$



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

$= \frac{N_0}{2} \left[\int_{-1/T}^{1/T} (1 - |fT|)^2 \, df + \int_{-2/T}^{2/T} df + 2 \int_{-1/T}^{1/T} (1 - |fT|) \, df \right]$

$= \frac{N_0}{2} \left[\frac{2}{3T} + \frac{4}{T} + \frac{2}{T} \right] = \frac{N_0}{2} \, \frac{2+12+6}{3T} = \boxed{\frac{10 N_0}{3T}}$

3) Simboli indipendenti, equiprobabili e simmetrici

$S_s(f) = \frac{1}{T} \sigma_x^2 |P(f)|^2 = \frac{1}{T} \cdot 1 \cdot \text{rect}\left(\frac{Tf}{4}\right) = \boxed{\frac{1}{T} \text{rect}\left(\frac{T}{4} f\right)}$

$\sigma_x^2 = E[x^2] = 1$ poiché $\eta_x = 0$

4) $H(f) = P(f) \, H_R(f) = H_R(f)$

$h(t) = h_R(t) = \frac{1}{T} \text{sinc}^2\left(\frac{t}{T}\right) + \frac{4}{T} \text{sinc}\left(\frac{4t}{T}\right)$

$$\boxed{h(nT) = \begin{cases} 5/T & n = 0 \\ 0 & n \neq 0 \end{cases}}$$

cond. di Nyquist nel tempo soddisfatta $\Rightarrow$ NO ISI

5) $$\boxed{P_E(b) = Q\left(\frac{5/T}{\sqrt{\frac{10 N_0}{3T}}}\right)}$$