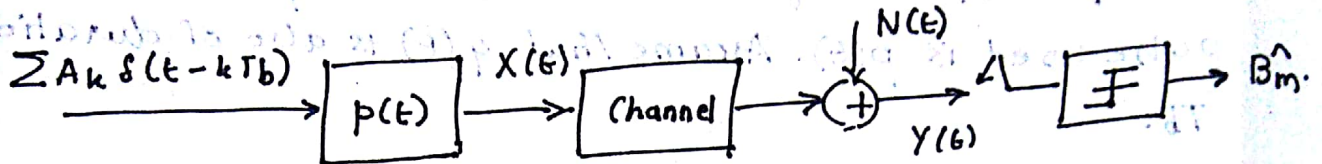


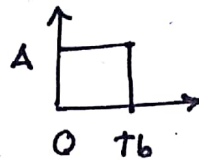
Please note that notation is as used in class.

1) Consider the following digital communication system.

$$(B_0, B_1, \dots, B_{M-1}) \rightarrow (A_0, A_1, \dots, A_{M-1}) \rightarrow \sum A_k \delta(t - kT_b)$$



- Suppose channel impulse response is $\delta(t) + \frac{1}{2} \delta(t - T_b)$
- Suppose $p(t)$ is a rectangular pulse

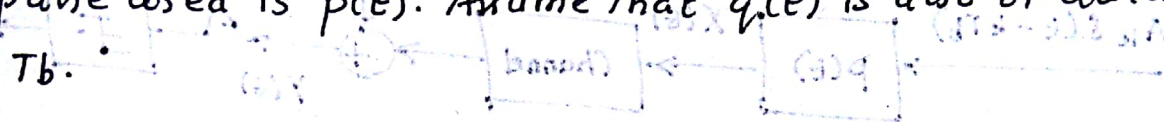


- $N(t)$ is a noise signal and modelled as a random process.
 - Samples of $c(X(t) + N(t))$ which is $Y(t)$ are taken every T_b , where $c(X(t))$ is the transformation of $X(t)$ by the channel. Let these samples of $Y(t)$ be Y_m .
 - The noise samples N_m in Y_m are assumed to be Gaussian with mean 0 and variance σ^2 .
 - Assume that the decision device has a threshold of 0.
- Find out an expression for BER (i.e., $\Pr\{\hat{B}_m \neq B_m\}$).

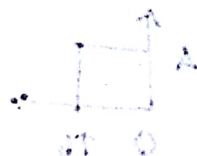
2) Suppose a digital communication system uses a line code with a pulse $p(t)$ of duration T_b . What is the impulse response of a matched filter, matched to $p(t)$? Show that the matched filter output can also be obtained from a correlator, for the sample at T_b .

at 10:00 AM

3) Suppose a digital communication system uses a line code with a pulse $p(t)$ of duration T_b . A receiver thinks that the pulse is $q(t)$ and uses a matched filter for $q(t)$. Compare the SNR value at the o/p of the matched filter for $q(t)$ at T_b with that for a matched filter for $p(t)$ when the pulse used is $p(t)$. Assume that $q(t)$ is also of duration T_b .



Suppose channel impulse response is $h(t) = \delta(t - T_b)$. Suppose $p(t)$ is a rectangular pulse



Let the received signal be $r(t) = p(t) + n(t)$, where $n(t)$ is a noise signal and modeled as a Gaussian process. Samples of $r(t)$ are taken every T_b . The receiver uses a matched filter for $q(t)$ to process the samples of $r(t)$. Let the samples of $r(t)$ be r_m . The noise $n(t)$ is assumed to be Gaussian with mean 0 and variance σ^2 . Assume that the decision device has a threshold of 0. Find an expression for BER (in terms of Q).

Suppose a digital communication system uses a line code with a pulse $p(t)$ of duration T_b . Let $h(t)$ be the impulse response of a matched filter matched to $p(t)$. Then the output of the filter can also be obtained from a correlation for the samples of $p(t)$.