Advanced Theory of Communication project

1. Write a program in MATLAB to

   (a) Simulate a system with 16-PSK modulation in an AWGN channel. Sketch the error probability curve versus $SNR = E_b/N_0$ for $0 \leq SNR \leq 12$dB with steps of 1dB. Compare the resultant figure with the theoretical error probability on the same figure and verify your simulations. Repeat this for 16-QAM modulation.

   (b) Simulate a system with DQPSK modulation in an AWGN channel. Note that you are not permitted to use MATLAB toolboxes. Sketch the error probability curve versus SNR for $0 \leq SNR \leq 12$dB with steps of 1dB.

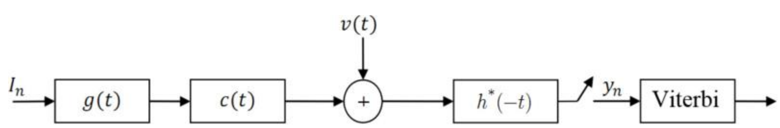
2. **:** Consider a BPSK modulation with pulse

$$g(t) = \begin{cases} 1/\sqrt{T} & 0 \leq t \leq T \\ 0 & \text{Otherwise} \end{cases}$$

Consider the channel impulse response as

$$c(t) = \begin{cases} 1/\sqrt{2T} & 0 \leq t \leq 2T \\ 0 & \text{Otherwise} \end{cases}$$

Assume that $T = 1$. The additive zero-mean noise at the receiver has variance $N_0/2$. At the receiver, we employ the matched filter $h*(-t)$ where $h(t) = g(t) * c(t)$ and after sampling at times $t = nT$, we make the detection by using y_n.



(a) Write a program in MATLAB for implementing the Viterbi block at the receiver. (You are not permitted to use MATLAB toolboxes.) You may consider the depth of Viterbi algorithm as 8. Sketch the error probability for this system for SNR in interval [0, 12] dB.

(b) If instead of the Viterbi algorithm, we employ a ZF equalizer with 5,9 and 13 taps, simulate and sketch the error probability for the same SNR interval as the previous part.

(c) If instead of the Viterbi algorithm, we employ a MMSE equalizer with 5,9 and 13 taps, simulate and sketch the error probability for the same SNR interval as the previous parts.

(d) If instead, we employ a DFE equalizer with 5,9 and 13 taps, simulate and sketch the error probability for the same SNR interval as the previous parts. You should consider the numberof feed-forward taps equal to number of feed-back taps plus one.

(e) Compare the results with the Viterbi algorithm