

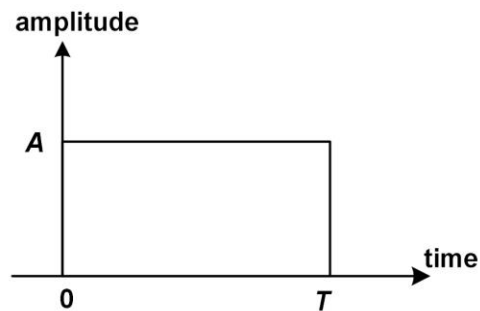


## Assignment 2

### Part I: Solve the following question:

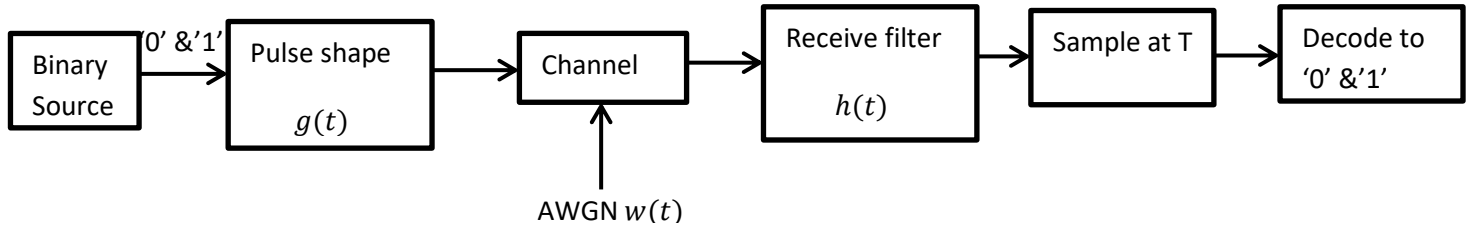
Given the pulse shape in Fig.1 and assuming that '1' and '0' are represented by a positive and a negative pulse, respectively.

- Plot the transmitted baseband waveform  $s(t)$  for the bit sequence  $b_0 = '0'$ ,  $b_1 = '1'$  and  $b_2 = '1'$
- Plot the matched filter output due to signal only, i.e., ignore the noise
- Mark the sampling instants to detect  $b_0$ ,  $b_1$  and  $b_2$ .
- Plot the block diagram of the transmitter
- Plot the block diagram of the receiver

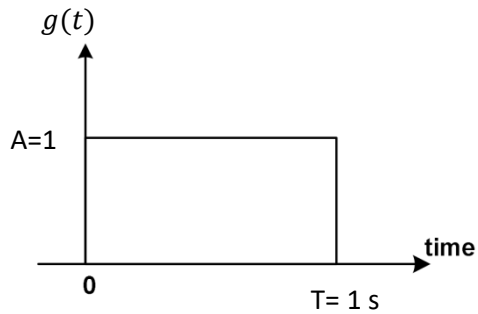


## Part II: Simulation:

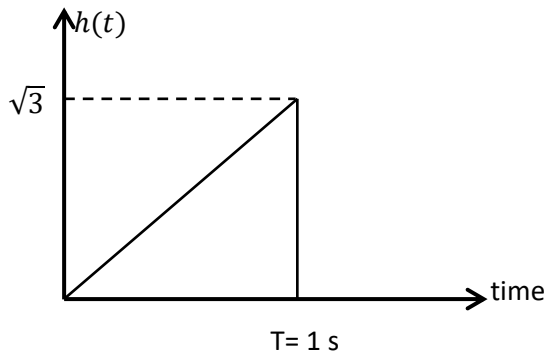
Consider the following communication system.



- The output of the binary source is a series of random 0's and 1's.
- The pulse shape  $g(t)$  is given below, where '1' is represented by  $g(t)$  and '0' by  $-g(t)$



- The channel is ideal (i.e. its impulse response is  $\delta(t)$ ).
- The noise is an AWGN with zero mean and variance  $N_0/2$ .
- Consider the three following cases:
  - a) The receive filter  $h(t)$  is a matched filter with unit energy
  - b) The receive filter  $h(t)$  is not existent (i.e.  $h(t) = \delta(t)$ )
  - c) The receive filter  $h(t)$  has the following impulse response



**Part II Requirements:**

1. Derive the probability of error in the three mentioned cases.
2. Write a Matlab code that generates random bits, simulates the above communication system, and calculates the probability of error for the three mentioned cases.
3. Plot the output of the receive filter for the three mentioned cases
4. On the same figure, plot the theoretical and simulated Bit Error Rate (BER) Vs  $E/N_0$  (where E is the average symbol energy) for the three mentioned cases. Take  $E/N_0$  to be in the range -10 dB: 20:dB. (Use a semilogy plot)
5. Is the BER an increasing or a decreasing function of  $E/N_0$ ? Why?
6. Which case has the lowest BER? Why?

**Deliverables:**

- Please deliver a single report that contains the solution to part I and part II.
- The solution of Part II should contain the theoretical derivation, the Matlab code, the required figures, and your comments to 5 and 6.