$\boxed{1}$

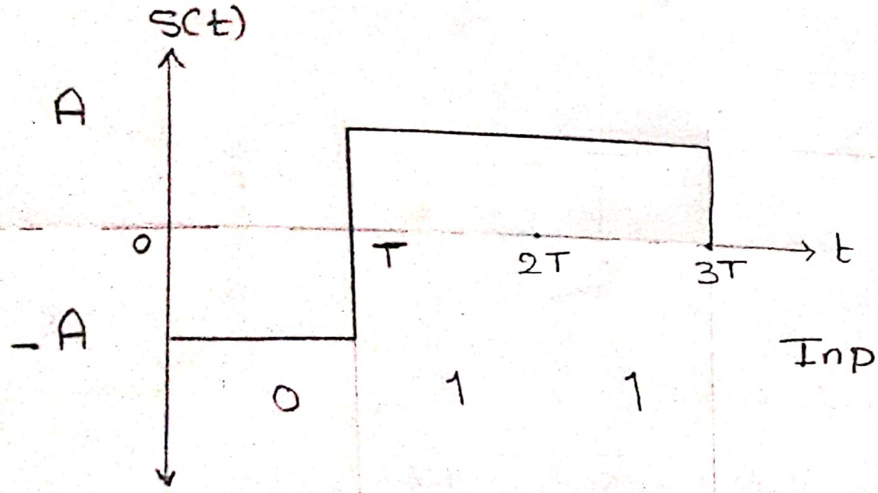
$$s(t) = m(t)\cos(2\pi f_c t + \phi)$$

bit 0 → $\phi = 0$ $\qquad$ $m(t) = A$

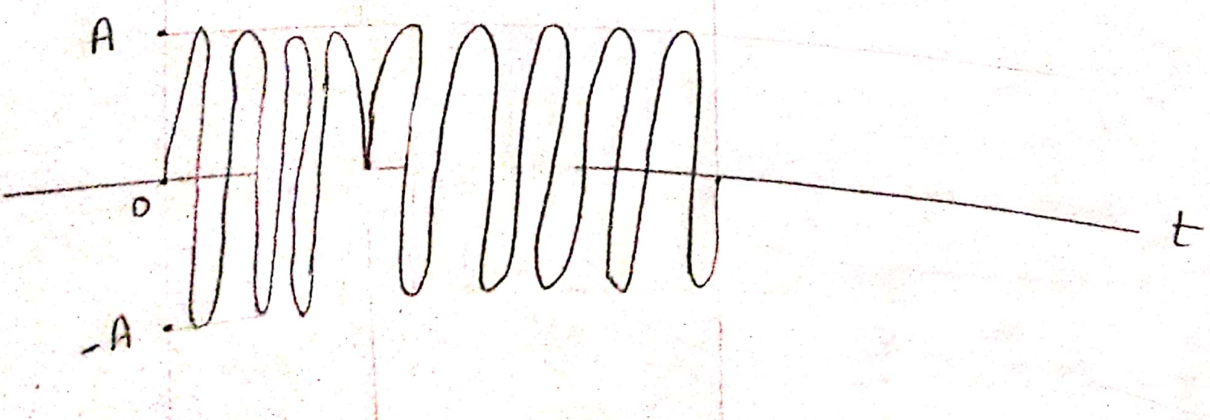
bit 1 → $\phi = 180$

For Binary 1 : $s_1(t) = A\cos(2\pi f_c t)$ $\qquad$ $0 \le t \le T_b$

For Binary 0 : $s_0(t) = A\cos(2\pi f_c t + \pi) = -A\cos(2\pi f_c t)$



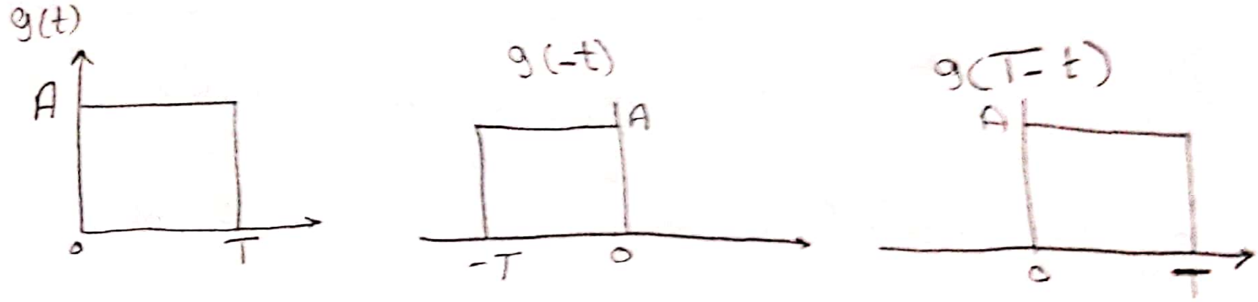
Input binary sequence



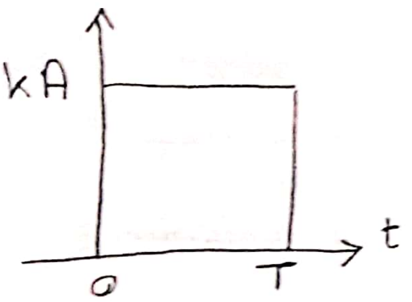
BPSK Modulated output wave

b) Plot matched filter

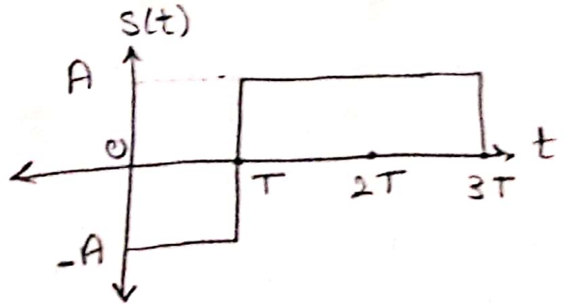
$$h(t) = kg(T-t)$$

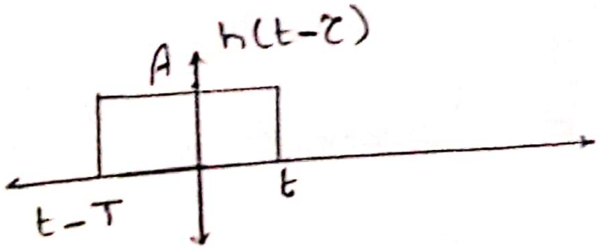


So $h(t)$ is



$$y(t) = s(t) * h(t) = \int s(\tau) h(t-\tau)\, d\tau$$





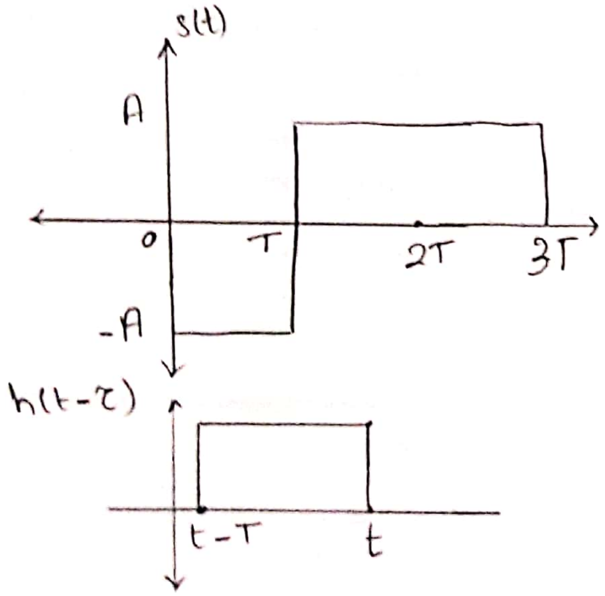
@ $t < 0 \longrightarrow y(t) = 0$

part 1

b) @ $0 < t < T$

$$y(t) = \int_0^t -A^2 \, d\tau = -A^2 t$$

@ $T < t < 2T$



$$y(t) = \int_{t-T}^{T} -A^2 \, d\tau + \int_{T}^{t} A^2 \, dt =$$

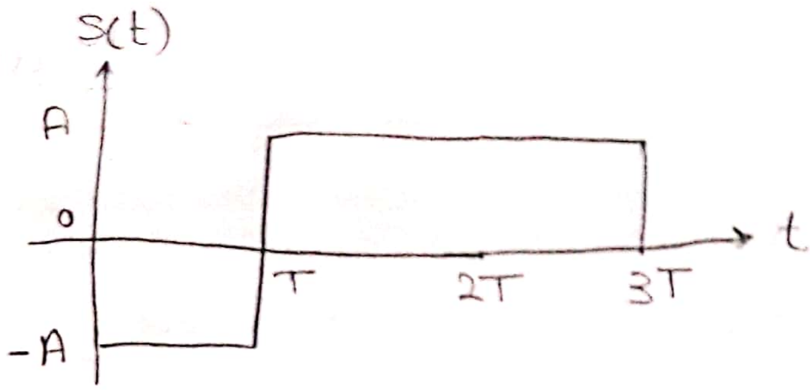
$$= -A^2 [T - t + T] + A^2 (t - T)$$

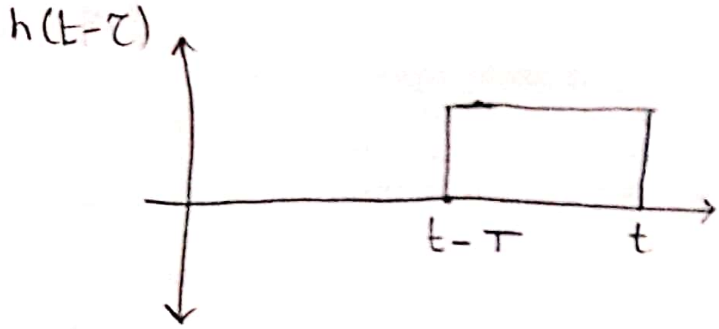
$$= -A^2 [2T - t] + A^2 [t - T]$$

$$= -2A^2 T + A^2 t + A^2 t - A^2 T$$

$$= -3A^2 T + 2A^2 t = A^2 (2t - 3T)$$

@ $2T < t < 3T$



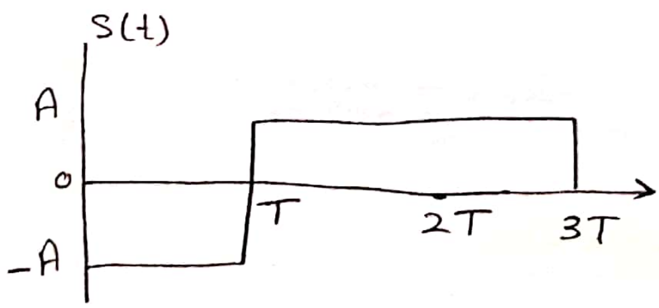


$$y(t) = \int_{t-T}^{t} A^2 \, d\tau = A^2(t-t+T) = A^2 T$$

@ $t > 3T$, $t-T < 3T$

$t < 4T$

@ $3T < t < 4T$

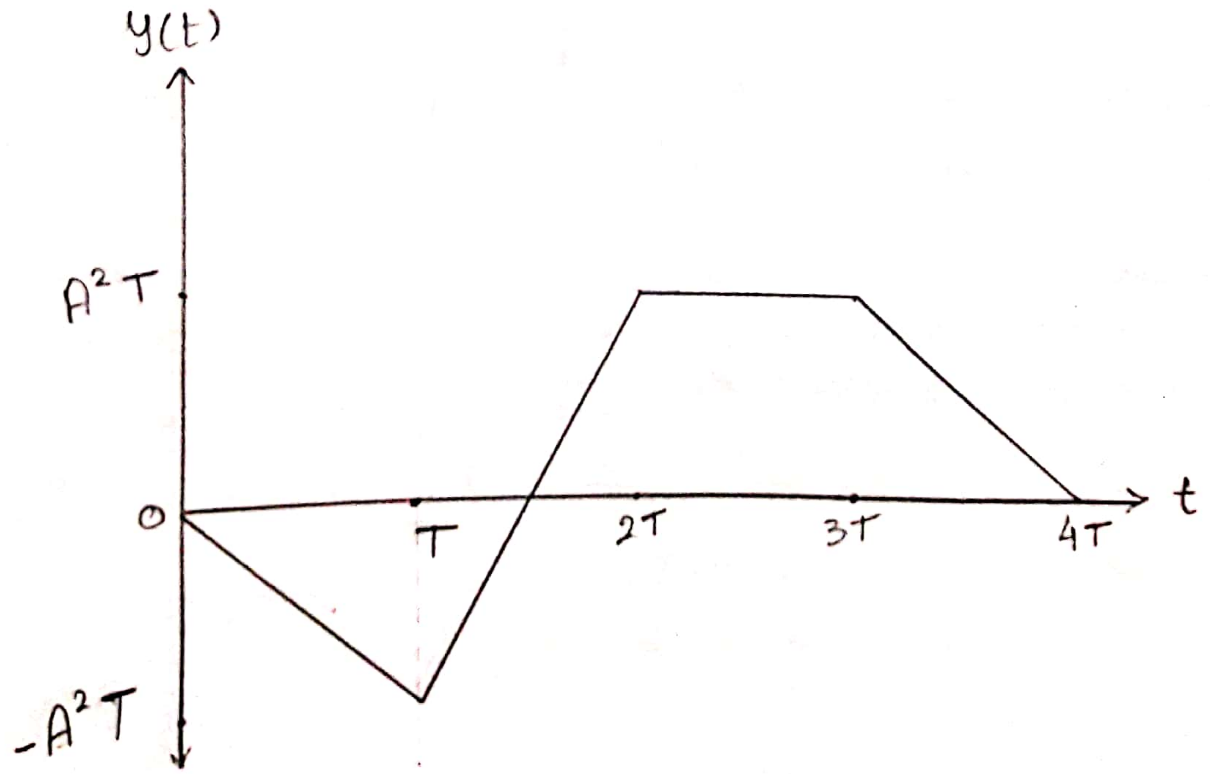


Scanned with CamScanner

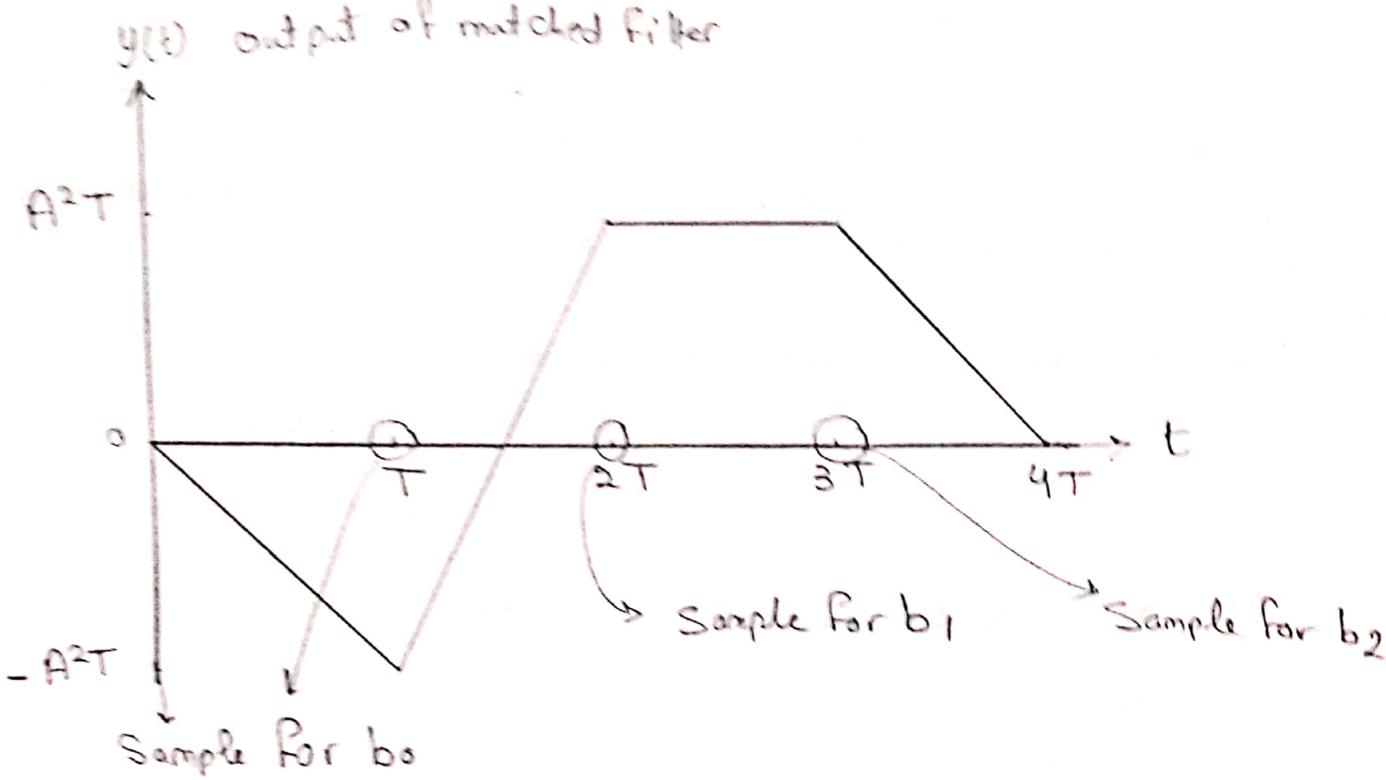
$$y(t) = \int_{t-T}^{3T} A^2\, dt = A^2 [3T - t + T] = A^2 [4T - t]$$

@ $t > 4T \longrightarrow y(t) = 0$

$$y(t) = \begin{cases} 0 & t \leq 0 \\ -A^2 t & 0 \leq t \leq T \\ A^2(2t - 3T) & T \leq t \leq 2T \\ A^2 T & 2T \leq t \leq 3T \\ A^2[4T - t] & 3T \leq t \leq 4T \\ 0 & t \geq 4T \end{cases}$$



c) Mark the sampling instants



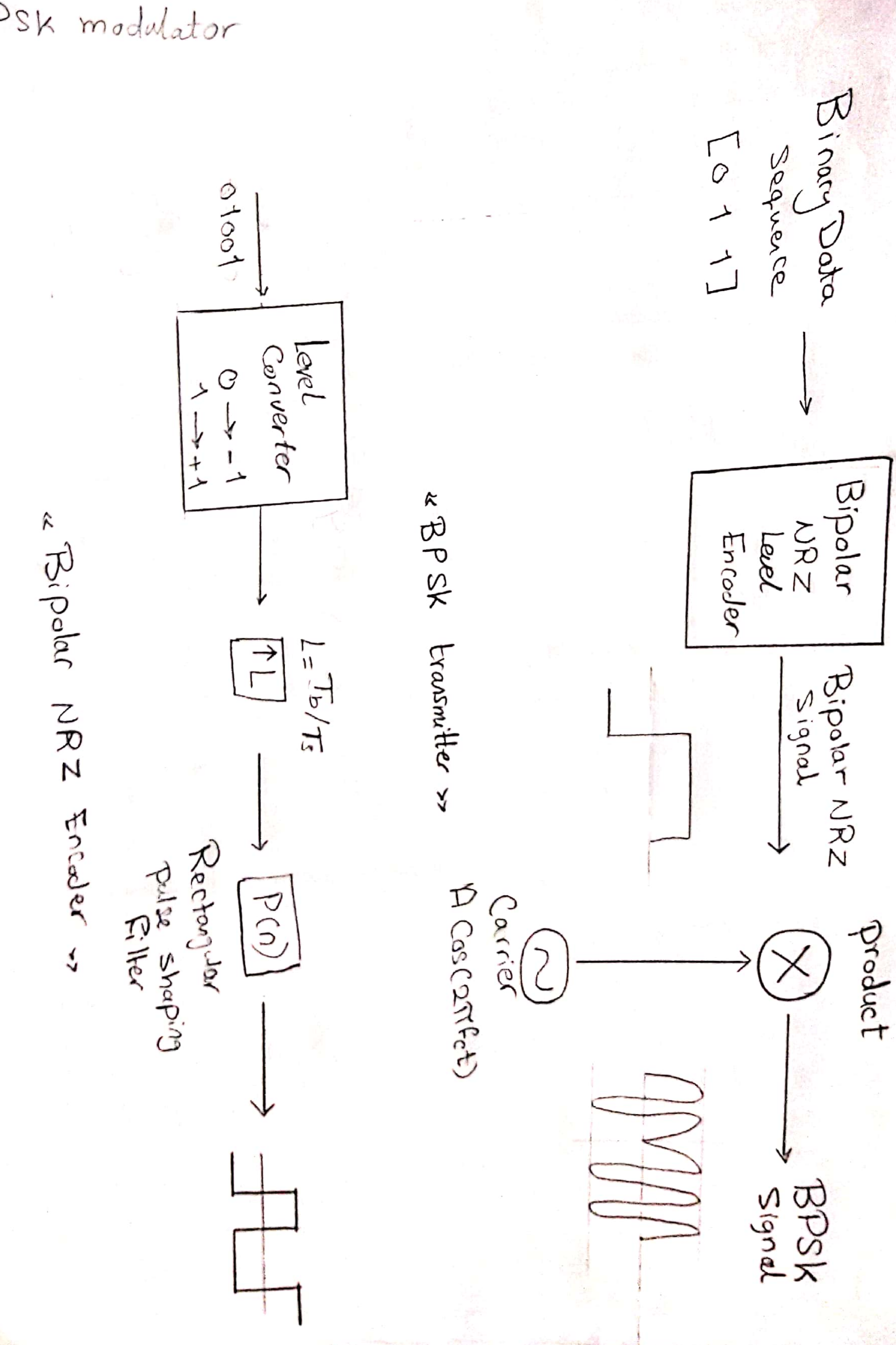
$t = T$ for b_0

$t = 2T$ for b_1

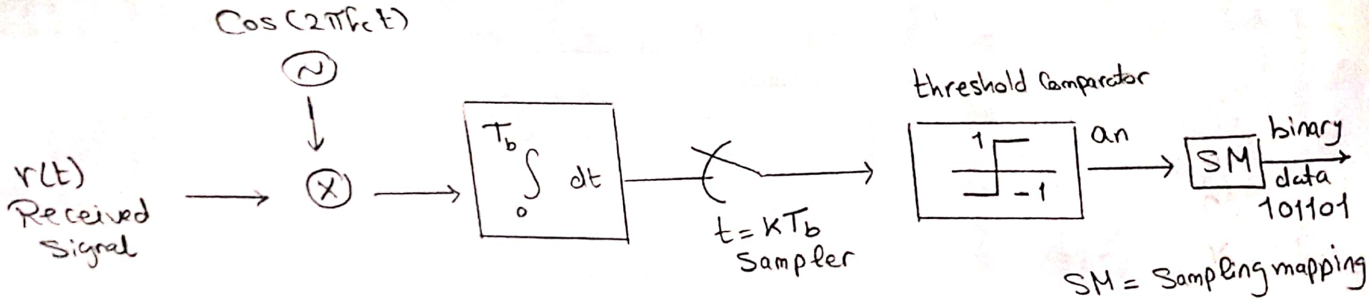
$t = 3T$ for b_2

d) Plot the block diagram of the transmitter

BPSK modulator



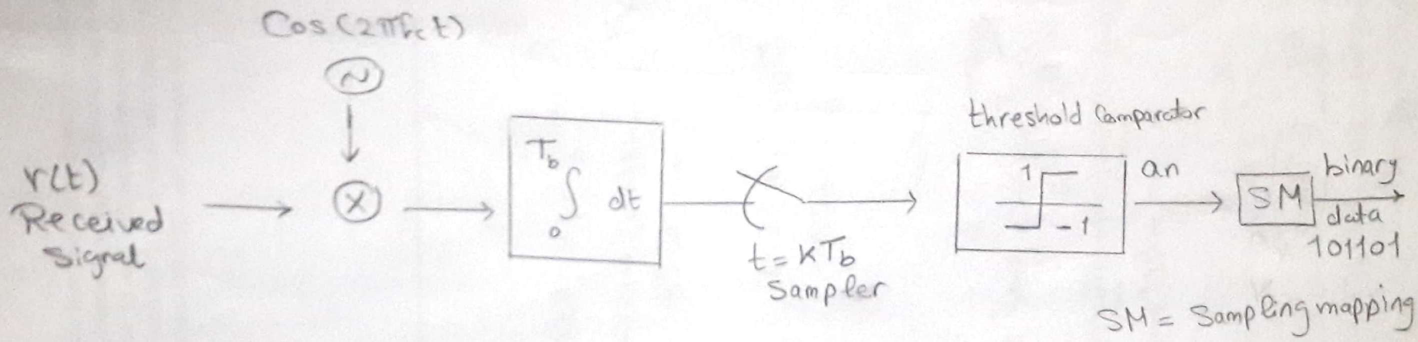
e)



BPSK Receiver

BPsk receiver

e)



* As in my matlab code

I illustrated more