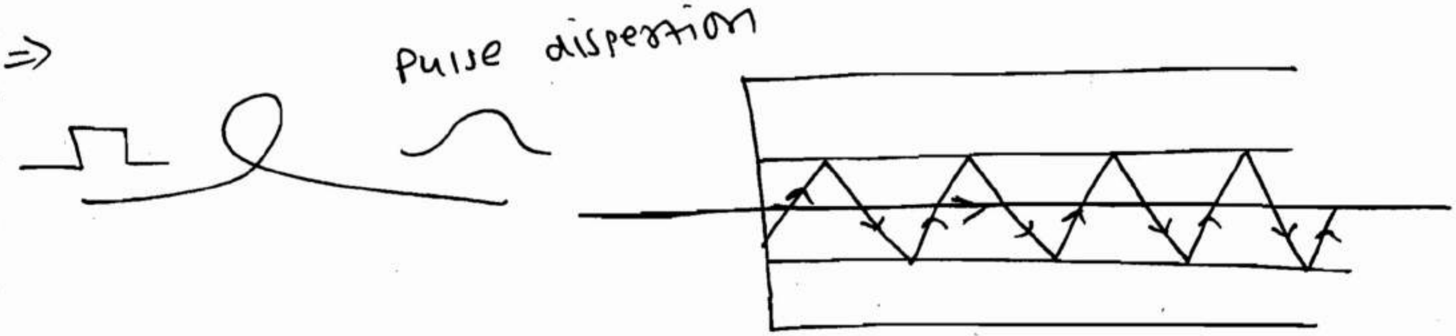
☆ Inter Symbol Interference :- (ISI):

⇒ When a Rectangular pulse is transmitted through a fiber optic cable, pulse dispersion occurs. In a fiber optic cable light signal is propogated through a core material by a mechanism called Total internal reflection.

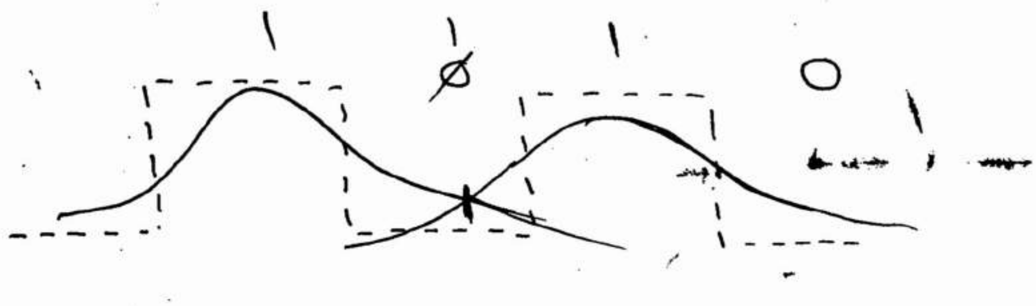
⇒ Due to variations in the propogation times of the light rays pulse dispersion occurres.

⇒



⇒ Assume that the binary data 1010 is transmitted through a fiber optic cable. Due to pulse dispersion the signal at the o/p will as shown in fig.

⇒



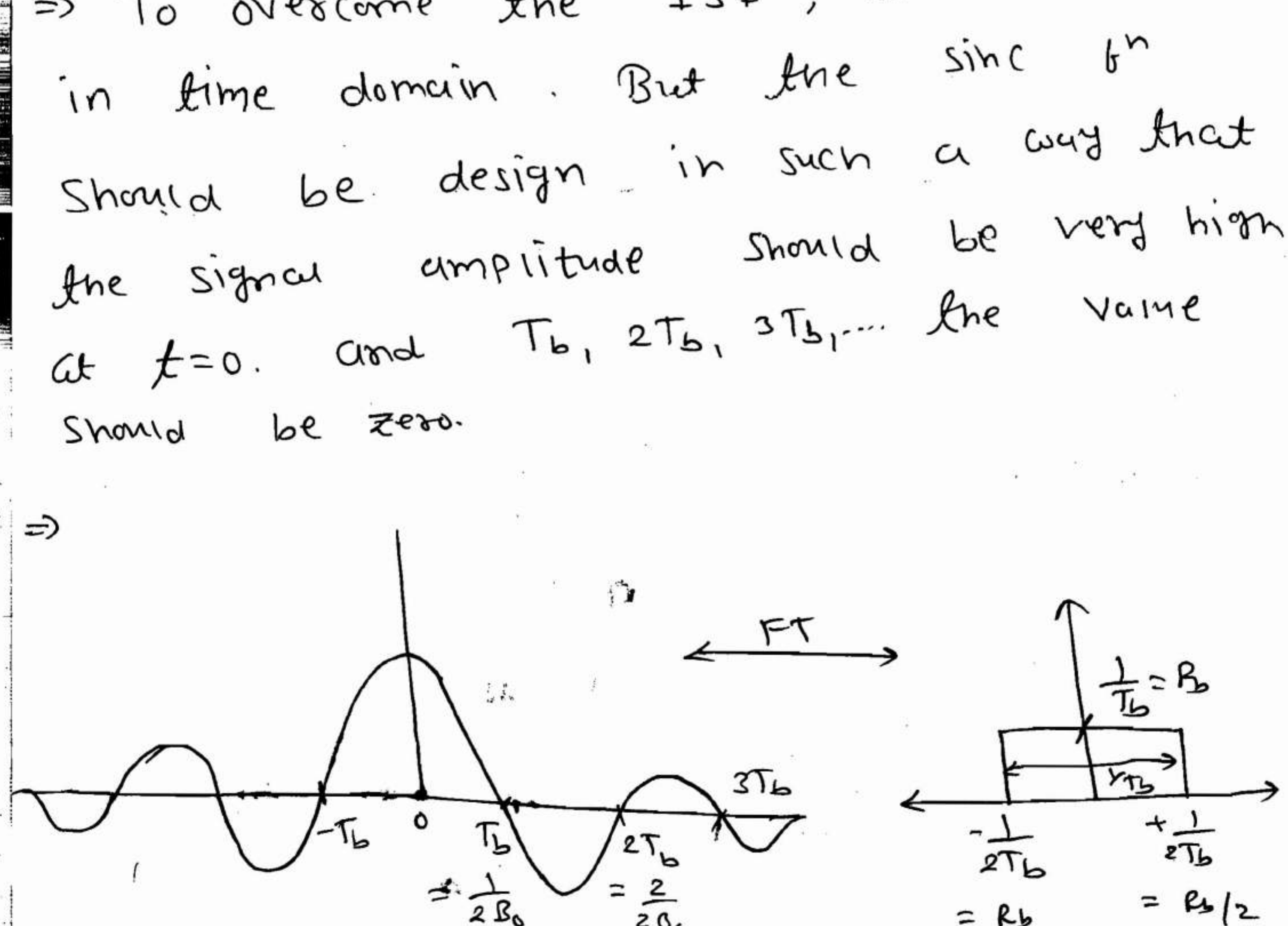
⇒ Due to ~~this~~ pulse dispersion, over lapping occurs and this phenomena is called as the <u>Inter Symbol Interference.</u> Due to this overlapping (or) ISI errors will occured.

⇒ To overcome the ISI pulse shapping is required.

⇒ To overcome the problem raised cosine pulse is used instead of rectangular pulses.

⇒ To overcome the ISI, sinc f^n is used in time domain. But the sinc f^n should be design in such a way that the signal amplitude should be very high at $t=0$. and $T_b, 2T_b, 3T_b, \ldots$ the value should be zero.

⇒



$p(t) = A\tau \,\text{sinc}(t\tau)$

here $\tau = R_b$, $A\tau = \frac{1}{R_b} \times R_b = 1$.

So, $\boxed{p(t) = \text{sinc}(R_b \cdot t)}$

⇒ BW of the sinc f^n is $R_b/2$.

So, the minimum BW of the channel required is $R_b/2$.

$$\boxed{B_0 = R_b/2 \quad Hz}$$ ← N.B

⇒ $R_b = 2B_0$.

$T_b = \frac{1}{2B_0}$. ← N.B.

⇒ $p(t) = \text{sinc}[2B_0 t]$

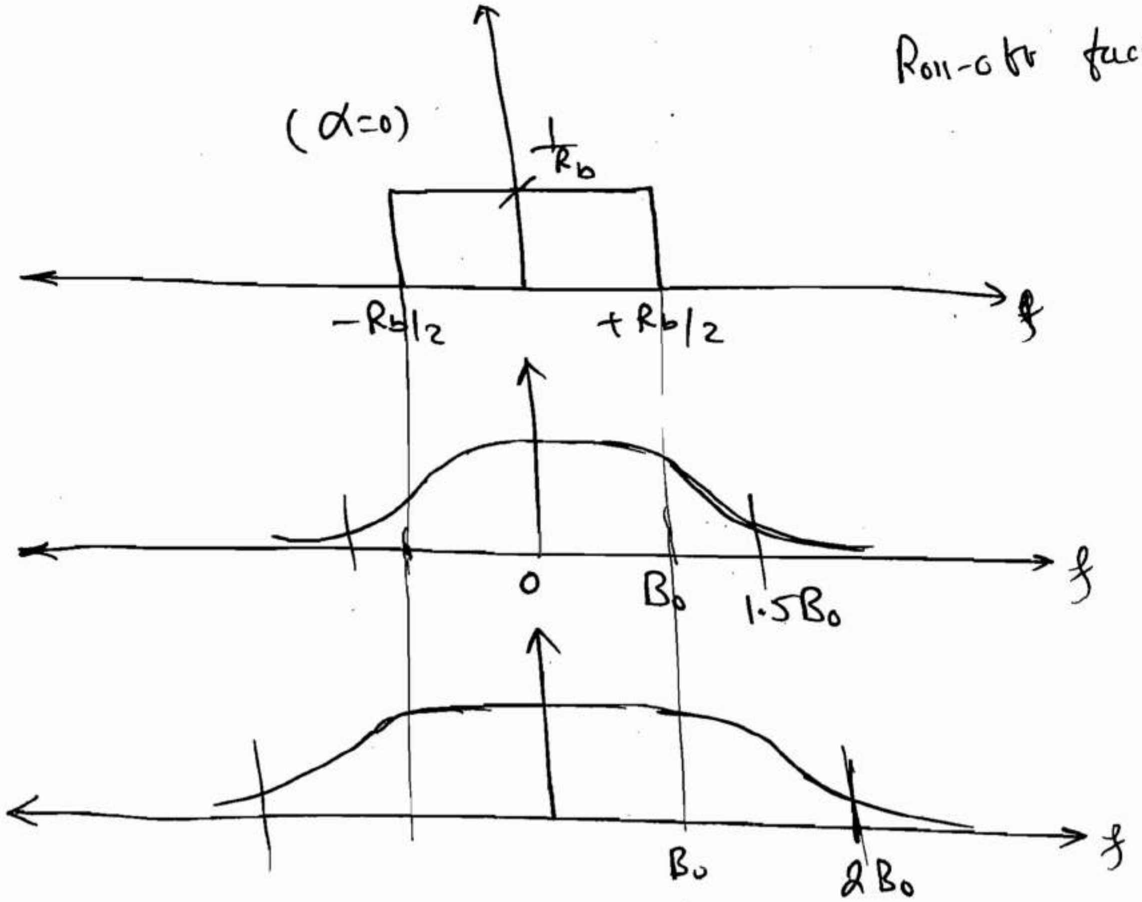
$$\boxed{p(t) = \frac{\sin[2\pi B_0 t]}{2\pi B_0 t}}$$ ← N.B

⇒ It is not possible to generate a Rectangular pulse in freq. domain.

⇒ In the practical case it is not sudden transition from one level to another level in freq. domain.

⇒

Roll-off factor



⇒ The transmission BW of the Raised Cosine f^n is.

$$\boxed{B_T = B_0[1+\alpha].}$$

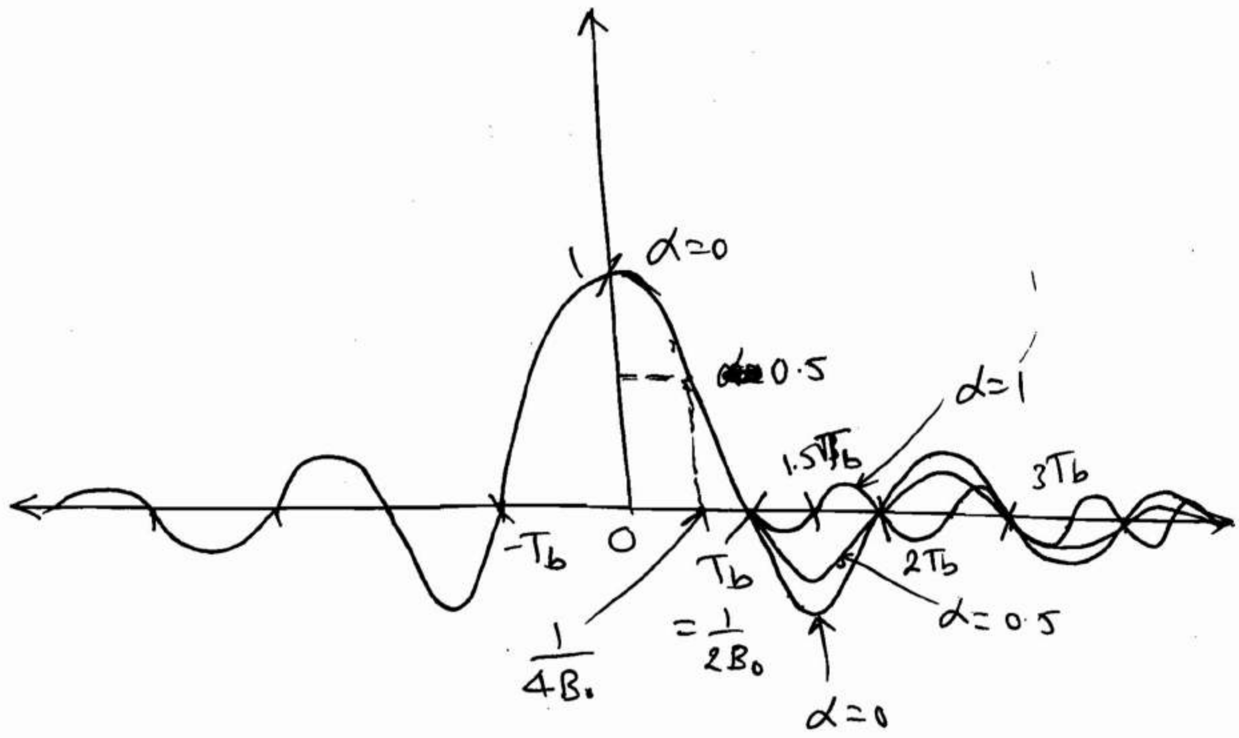
α = Roll-off factor.

⇒ When $\alpha = 0$, $B_T = B_0 = \frac{R_b}{2} = \frac{1}{2T_b}$. So, the minimum BW required to transmitt the signal is $R_b/2$.

⇒ When $\alpha = 1$.

$$B_T = B_0[1+1] = 2B_0 = \frac{2.R_b}{2}$$

⇒



⇒	$\alpha = 0 \rightarrow p(t) = \text{sinc}[2B_0 t]$	
⇒	$0 < \alpha < 1 \rightarrow p(t) = \dfrac{\text{sinc}[2B_0 t] \cdot \cos 2\pi B_0 t \alpha}{1 - 16\alpha^2 B_0^2 t^2}$	
⇒	$\alpha = 1 \rightarrow p(t) = \dfrac{\text{sinc}[2B_0 t]}{1 - 16 B_0^2 t^2}$	

Q

→ The data o/p in a digital Communication system 50 KBPS. To transmit the binary data without ISI. Determine the BW of the channel required.

(i) $\alpha = 0$.

(ii) $\alpha = 0.5$

Soln: Here, $R_b = 50$ KBPS.

$$\therefore \quad B_0 = \frac{R_b}{2} = 25 \text{ KHZ}.$$

① $\alpha = 0$.

$$B_T = B_0 [1 + \alpha] = B_0 [1 + 0] = B_0$$

$$\boxed{B_T = 25 \text{ KHZ}}$$

② $\alpha = 0.5$

$$B_T = B_0 [1 + \alpha] = B_0 [1 + 0.5]$$

$$B_T = 1.5 B_0$$

$$= 1.5 \times 25 K$$

$$\boxed{B_T = 37.5 \text{ KHZ}}$$

③ $\alpha = 1$

$$B_T = B_0 [1 + \alpha] = B_0 [1 + 1]$$

$$B_T = 2 B_0$$

$$\therefore \boxed{B_T = 50 \text{ KHZ}}$$