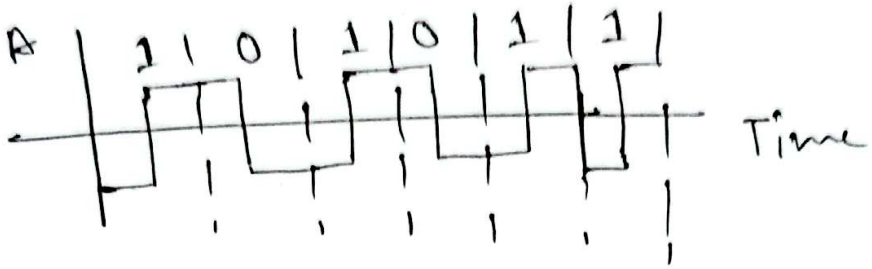
line coding

Biphase

0 ⇒ ⊓ pos to neg

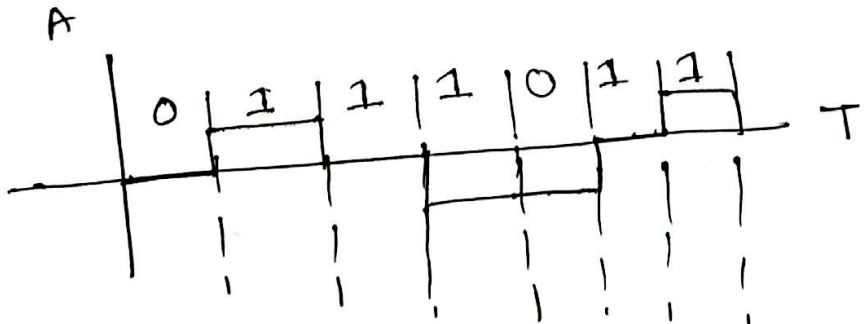
Manchester: IEEE 1 ⇒ ⊔ neg to pos



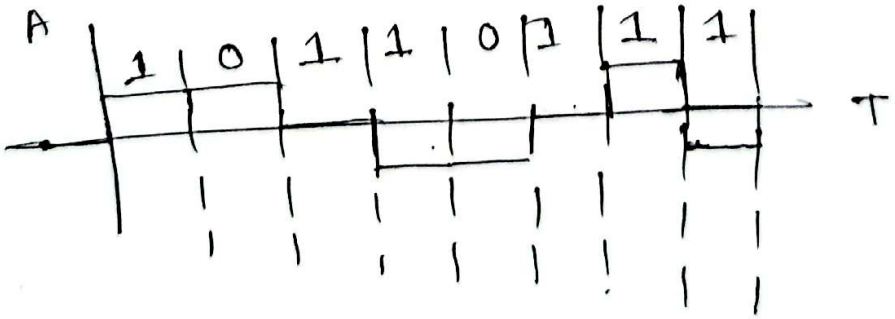
MLT-3

Multitransmission-3: 0 – no transmission

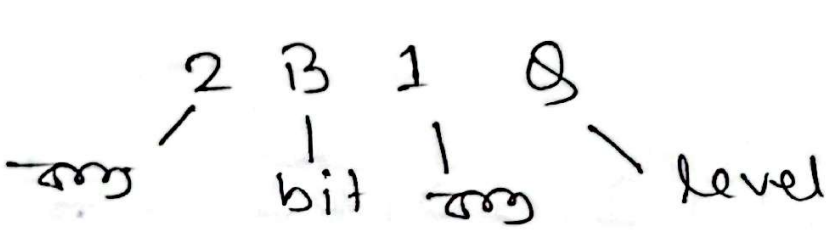
1 → current level 0 or not?
if not bring to 0.
if 0 then opposite to non zero.



[Assume last level was zero and last non zero level was negative]

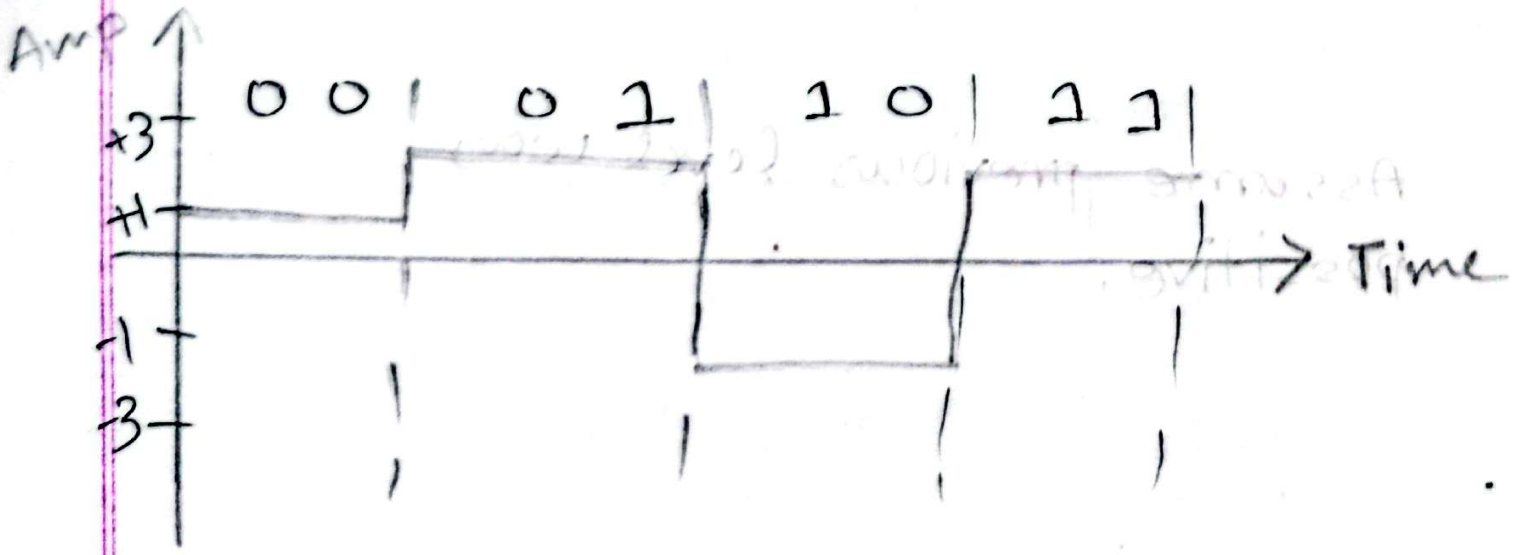


Multi-level:



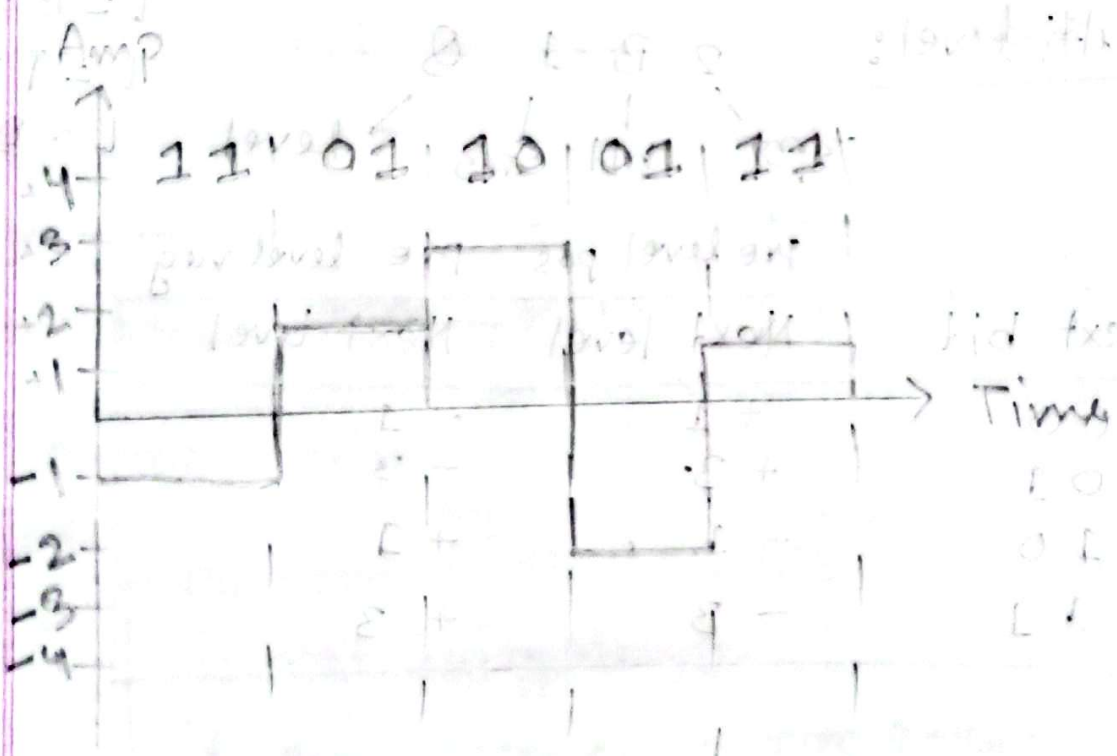
L = B = 2
L = T = 3
L = 8 = 4

	Pre level pos	Pre level neg
Next bit	Next level	Next level
0 0	+ 1	- 1
0 1	+ 3	- 3
1 0	- 1	+ 1
1 1	- 3	+ 3



Ex:

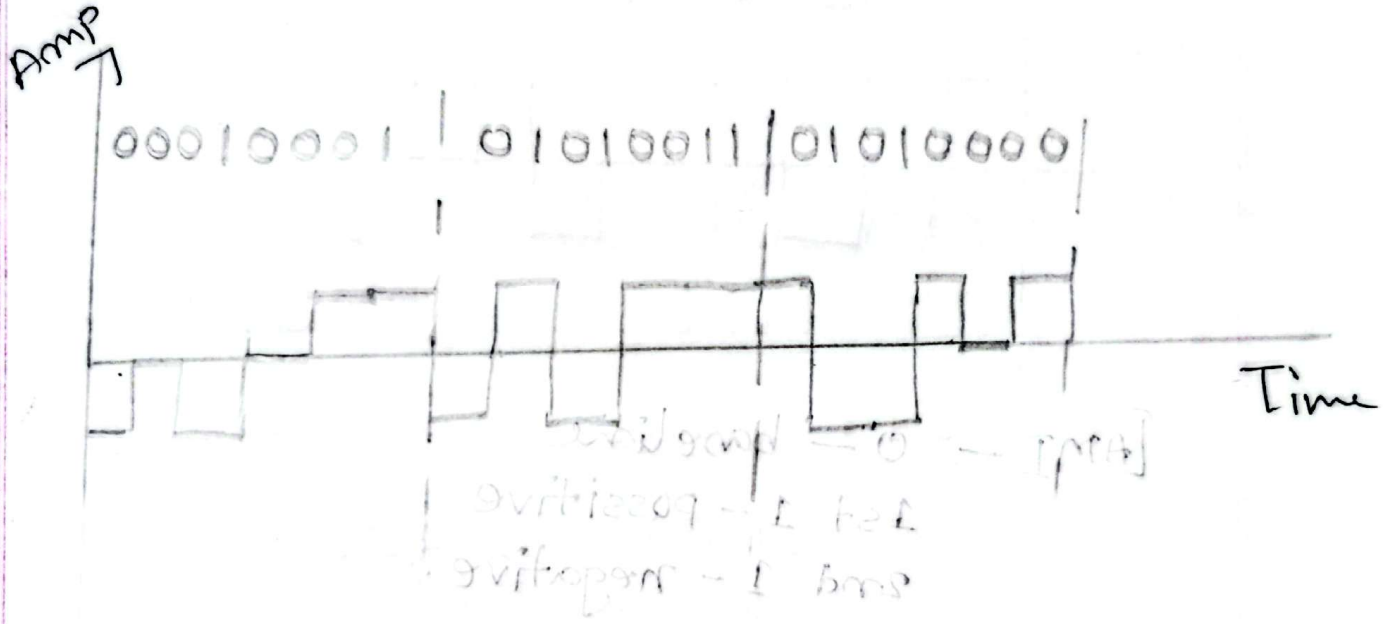
Next bit	pre pos Next level	pre neg Next level
00	+4	-4
10	+3	-3
11	-1	+1
01	-2	+2



Assume previous level was positive.

8B6T:

Data	Code
00010001	− 0 − 0 + +
01010011	− + − + + 0
01010000	+ − − + 0 +
~~111111~~	~~+ − − + 0 +~~

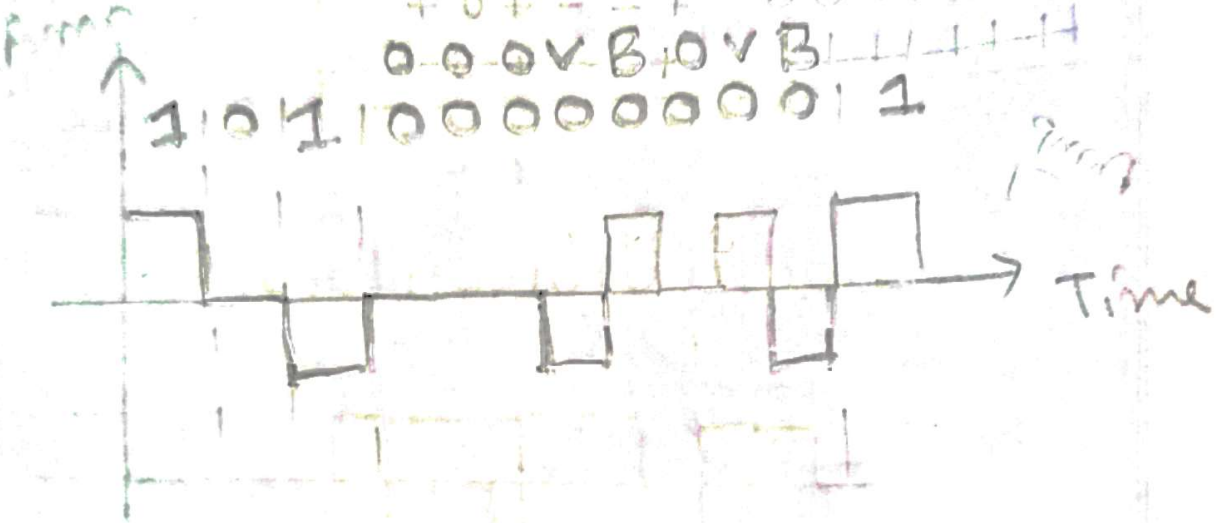


Scrambling:

B8ZS ⇒ Bipolar 8 zero substitution

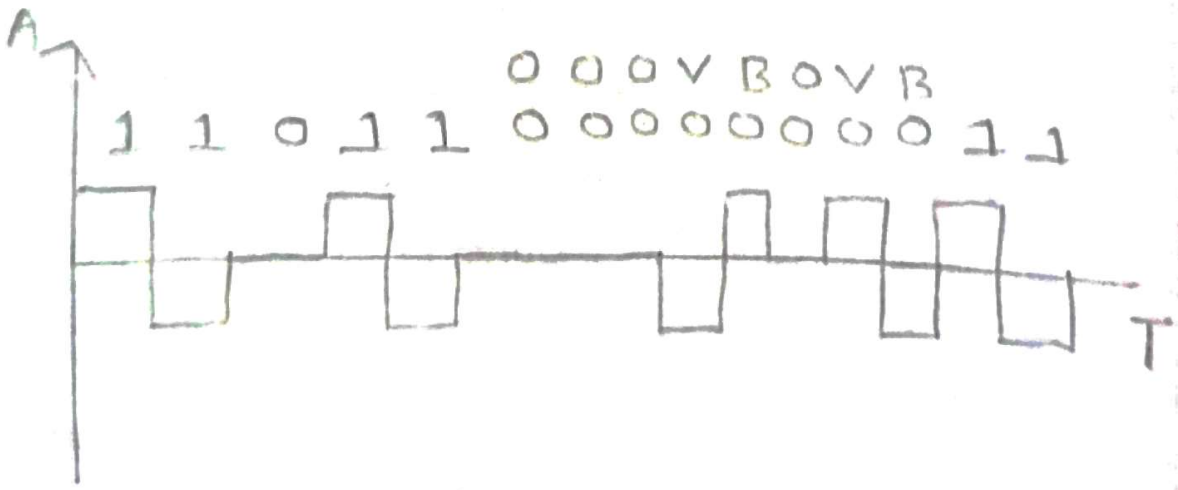
V → Same last non zero

B → Opposite last not zero.



[AMI — 0 — baseline
1st 1 — possitive
2nd 1 — negative.

Ex:



Scrambling:

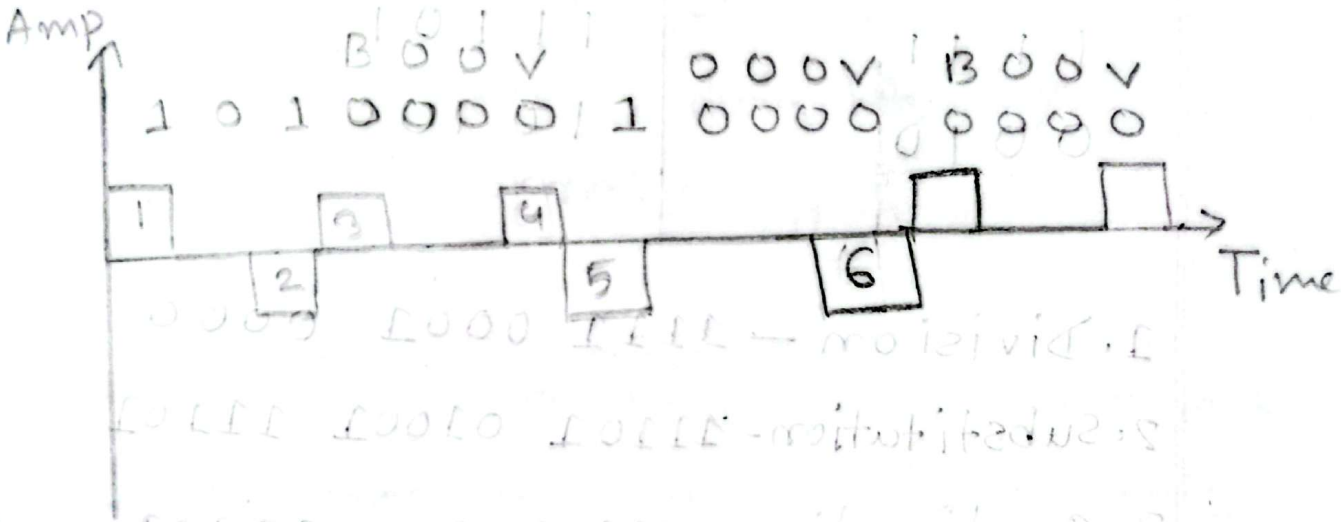
HDB3 — High density bi-polar 3

V → same last non zero

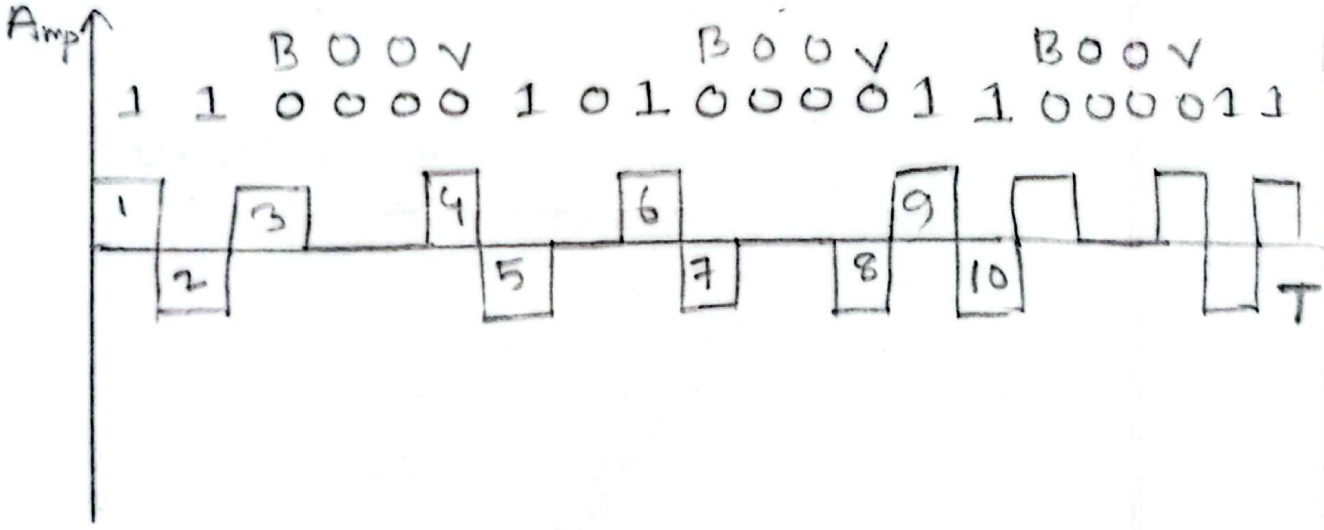
B → opposite last non zero

Even – B00V

Odd – 000V



Ex:



Block coding:

4B/5B

Datat = 1 1 1 1 0 0 0 1 0 0 0 0

Data sequence	Encoded sequence
0 0 0 1	0 1 0 0 1
0 0 0 0	1 1 1 1 0
1 1 1 1	1 1 1 0 1
0 0 1 0	1 0 1 0 0

1. Division — 1111 0001 0000
2. Substitution - 11101 01001 11101
3. Combination - 11101010011111 01.

Chapter-5:

Digital to analouge signal

1. ASK - Amplitude shift keying
2. FSK - Frequency shift keying
3. PSK - phase shift keying

N → bit rate / bps

(*) $S = N \times \frac{1}{r}$ —— No. of data bits per signal.

5.1 An analouge signal carries 4 bit per signal elements. If 1000 signal elements are sent per second find bit rate.

Soln: Given, $r = 4$

$S = 1000$

$$S = N \times \frac{1}{r}$$

$$N = Sr$$

$$= 1000 \times 4$$

$$= 4000 \text{ bps.}$$

5.2 An analouge signal has 8000 bps and a boud rate 1000 boud. How many data elements are carried by each signal element.

Soln: Given, N = 8000 bps

S = 1000 boud

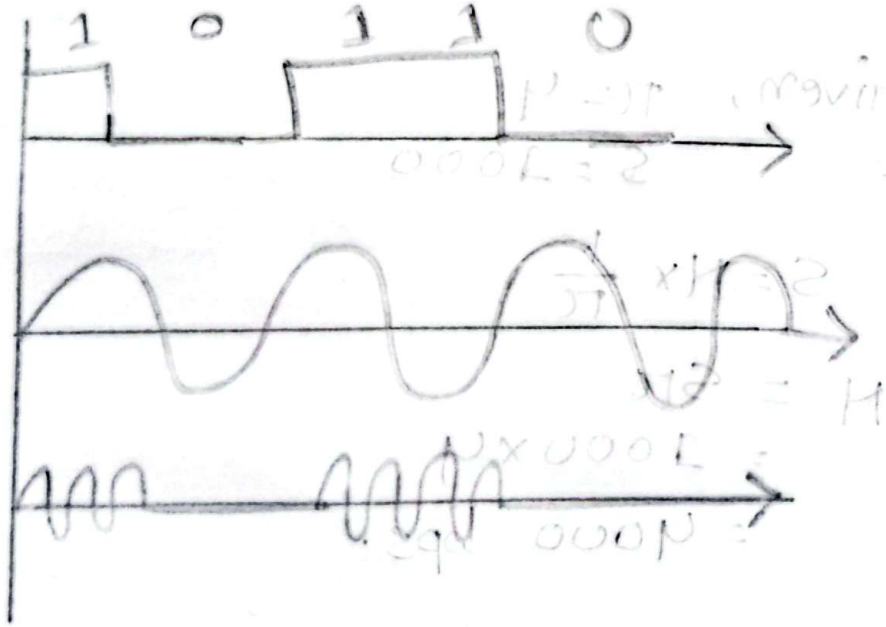
$$S = N \times \frac{1}{r}$$

$$r = \frac{N}{S}$$

$$= \frac{8000}{1000}$$

= 8 boud rate (Ans)

ASK:



- $B = (1+d) \times S$ — signal rate
  - Effect of modulation and filtering on bandwidth (0-1)
  - Bit rate.

5.3 Available bandwidth 100KHz, which spans from 200 to 300 KHz. What are the carrier frequency? and bit rate using Ask with d=1 ?

Soln:

$$\text{carrier frequency} = \frac{200+300}{2}$$

$$= 250\text{KHz}$$

$$B = (1+d) \times S$$

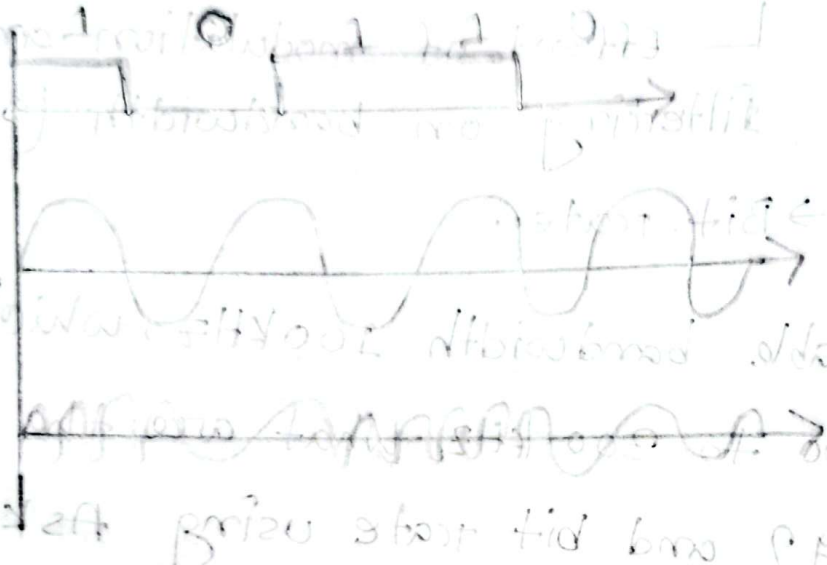
$$100 = (1+1) \times N \times \frac{1}{r} \quad \Big| \quad r = 1$$

$$100 = 2 \times N$$

$$N = \frac{100}{2}$$

$$= 50 \text{ kbps}.$$

FSK:



- $B = (1+d) \times S + 2\Delta f$

Δf – Differences between two frequency

- $2\Delta f = 2.5$

5.4:

Given, $B = 100\ KHz$

$\Delta f = 300 - 200$

$= 100\ KHz$

$d = 1$

$n = 1$

$B = (1+d) \times S + 2\Delta f$

$= (1+1) S + 2\Delta f$

$= 2S + 2\Delta f$

$= 2S + 2S$

$B = 4S$

$S = \frac{B}{4}$

$= \frac{100}{4}$

$= 20\ kbps.$

PSK :