U → 02

Ch – I

Transmission Media

T.M

→ Wired (Guided)

→ wireless (unguided)

Wired (Guided) :-

① Twisted pair cable → STP, UTP } ppt.

② coaxial cable. :-

ⓐ It is used by telecom companies, cable operator ISP.

ⓑ it is a copper cable built with metal shield to protect against cross talk.

NOTE :- coaxial cable provides better protection against cross talk than STP.

* 50 Ω → digital. Analog ← 75 Ω

* optical fibre cables → (best, expensive, fastest)

Attenuation

① $$dB = 10 \log_{10}\left(\frac{P_2}{P_1}\right)$$

P_1 → input signal

P_2 → output signal.

Q.) suppose a signal travells through a medium and its power is Reduced to 1/2 that is $\left(P_2 = \frac{1}{2} P_1\right)$ • calculate attenuation.

Sol → $dB = 10 \log_{10} \times \frac{0.5 \cancel{P_1}}{\cancel{P_1}} = 10 \times (-0.3) = -3\ dB.$

Q. signal travels through a med and its power is inc. 10 time $(P_2 = P_1 \times 10)$.

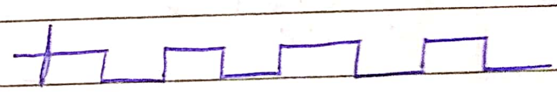
$A = 10 \log_{10} \times \frac{10 \times \cancel{P_1}}{\cancel{P_1}} = 10 \times 1 = 10\ db.$

SNR (Signal to Noise Ratio)

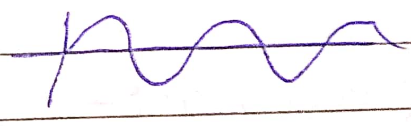
$$\boxed{SNR = \frac{\text{signal cover}}{\text{Noise}}}$$

chapter → 02 data and signals

- digital → discrete



- Analog → continuous

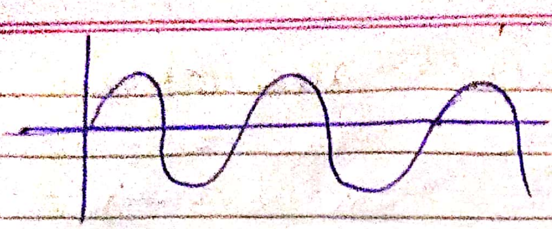


Periodic signals

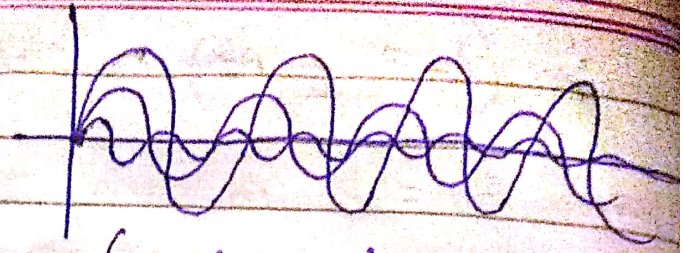
⇒ The signals that repeat after a fixed interval of time and vice versa for Aperiodic.

* Periodic are of two types :-

① Simple signals	② Composite signals
→ can't be decomposed breaked.	→ They are made by multiple sine waves. (simple)



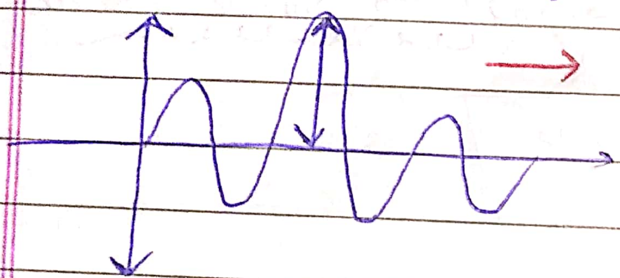
I sine wave.



(more sine waves)

* Sine wave is represented by the following elements :-

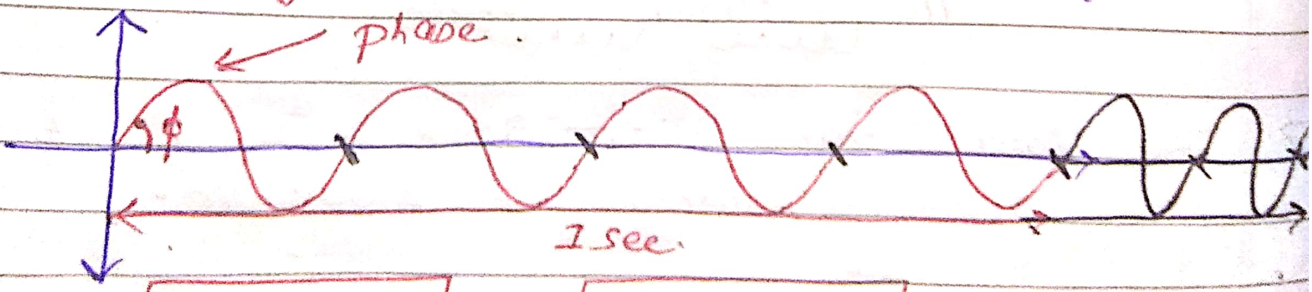
① Amplitude :- Highest intensity.



{highest peak value is Amplitude.}

② Period :- The time in sec to complete 1 cycle.

③ Frequency :- No. of periods in 1 cycle sec



$$\boxed{f = \frac{1}{T}} \qquad \boxed{T = \frac{1}{f}}$$

$\boxed{\text{Std. unit} = Hz}$

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freq = 6 HZ.

phase → position of waveform with relative to time = 0.

TABLE

unit		equivalent
sec	→	1 sec
millisec	→	10^{-3} sec
microsec	→	10^{-6} sec
Nano sec	→	10^{-9} sec
pico sec	→	10^{-12} sec
HZ	→	1 HZ
KHZ	→	10^{3} HZ
MHZ	→	10^{6} HZ
GHZ	→	10^{9} HZ
teraHZ	→	10^{12} HZ

The power we use at home is a freq 60HZ. calc. period?

$f = 60HZ.$ $T = \frac{1}{f} = \frac{1}{60}$ s

$1ms = 10^{-3}$ s $1s = 10^{3}$ millis

$\frac{1}{60} \times 10^{+3} = 16.6$ ms. Ans

Q. Convert 100 ms to μs. ?

Soln → $1\ ms = 10^{-3}\ sec$

$100ms = 100 \times 10^{-3}\ sec = 10^{-1} sec$

$1s = 10^{6}\ \mu s$

$10^{-1}s = 10^{-1} \times 10^{6} = 10^{5}\ \mu s$ Ans

① $\boxed{\text{wavelength} = \text{propagation speed} \times \text{period (tim}}$

$= \left(\frac{p.s}{freq}\right)$

② $\boxed{\text{Bandwidth} = fh - fl}$

$\downarrow$

high freq − low freq.

Q.) if a periodic signal is decomposed into 5 freq 100, 300, 500, 700, 900.

Soln → $B = 900 - 100 = (800\ Hz)$ A

Q.) $B = 20Hz$. $fh = 60Hz$ $f_L = ?$

$20 = fh - f_L = 60 - f_L = f_L = 60 - 20 = 40Hz$.

③ $\boxed{\text{No. of bits per level} = \log_2 L}$

L = No. of levels.

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Q.) A digital signal has 9 level find No of B per level.

Sol: $\log_2 9 = \frac{\log 9}{\log 2} = 3.17$ Ans

(4) $\boxed{\text{Bit length} = \text{prop. speed} \times \text{bit - duration}}$

Data - Rate limits

unit :- (bps) (bits per second.)

(1) Noiseless channel :- Nyquest bit Rate

$$\boxed{\text{Bit Rate} = 2 \times \text{Bandwidth} \times \log_2 L}$$

L = No. of levels (S.I unit = bps)

Q.) Consider a Noiseless channel of bandwidth of 300 Hz and two signal level calculate the Bit Rate.

$B.R = 2 \times 300 \times \log_2 2 = 600$ bps

Q.) We need to send 265 kbps over a noiseless channel with a bandwidth of 20 kHz

$B \cdot R = 265 \times 1000 = 265000$

$B \cdot W = 20,000 \; Hz$.

$265000 = 2 \times 20,000 \times \log_2 L$

$6.625 = \log_2 L$

$L = (2)^{6.625} = 98.70$

$l = 98.70$ Ans

o ===== o

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② Noisy channel :- (Shanon capacity)

$$\boxed{\text{capacity} = \text{Bandwidth} \times \log_2 (1 + SNR)}$$

Q.) $B = 3000\ Hz$ $SNR = 3162.$

$C = 3000 \times \log_2 (1+3162)$

$3000 \times \log_2 (3163)$

$3000 \times \frac{\log 3163}{\log 2}$

$3000 \times 11.62 = 34860.$ B.P.S.

consider decimals upto two places.

Q.) $B = 1\ MHZ = 10^6\ HZ.$ $SNR = 63$

$C = 10^6 \times \log_2 64$ $2 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$C = (10^6 \times 6)$ B.ps A

#to formulaes

① $\boxed{\text{Throughput} = \frac{\text{data size}}{\text{transmission time}}}$

② $\boxed{\text{prop. time} = \frac{\text{distance}}{\text{speed}}}$

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(3) $\boxed{\text{Transmission time} = \dfrac{\text{Message size}}{\text{bandwidth}}}$

$$\left\{\begin{array}{l} 1\ Gps = 10^9\ bps \\ 1\ Mbps = 10^6\ bps \end{array}\right\}$$

(Q.) $d = 12{,}000$ km. $S =$

(Q.) t·time = ? p·time = ?

$d = 12000 km$ $S = 2.4 \times 10^8 m/s$

$P \cdot T = \dfrac{d}{s} \cdot \dfrac{12000 \times 1000}{2.4 \times 10^8}$ $\dfrac{12}{2.4 \times 10}$

$0.05 \times 10^{3} = 50$ ms. $\dfrac{12}{240}$

$T \cdot T = \dfrac{mg\ size}{B} = \dfrac{2500 \times 8}{10^9}$

$\dfrac{20000}{10^9}$ $\dfrac{2}{10^5} \times 10$

$\dfrac{2}{10^6}$ $\dfrac{2}{100}$

0.02

ms

(Q.)

~~500~~

$\dfrac{5 \times 10^6 \times 8}{\cancel{10^6}} = 40 \times 10^3$

40,000 ms.

chapter → 03 Line coding

⇒ Line coding is also known as digital to dig. conversion

① unipolar - NRZ (NON Return to zero)

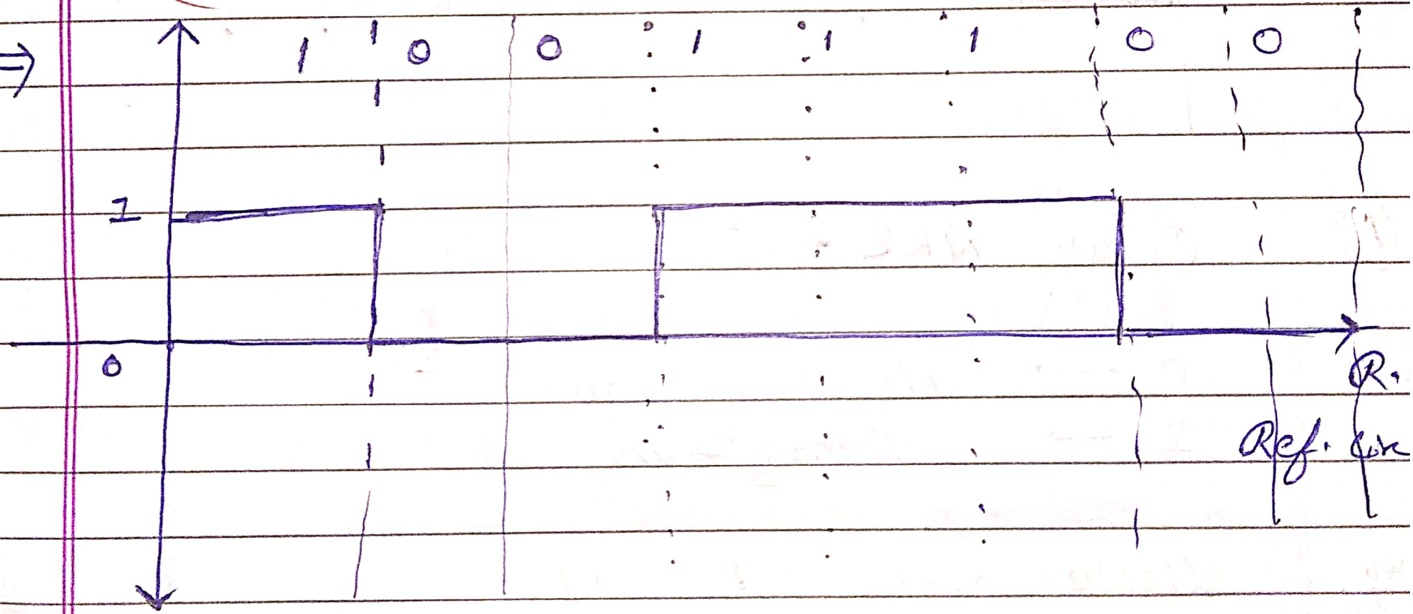
→ Here we convert digital data to digital signals

① unipolar - NRZ (Non- Return to zero.)

1 → Above RL.
0 → on RL.

eg. (10011100) digital data.

⇒



make dotted lines and then Combn.

2nd method ↓

② Polar (NRZ) (

2 types.

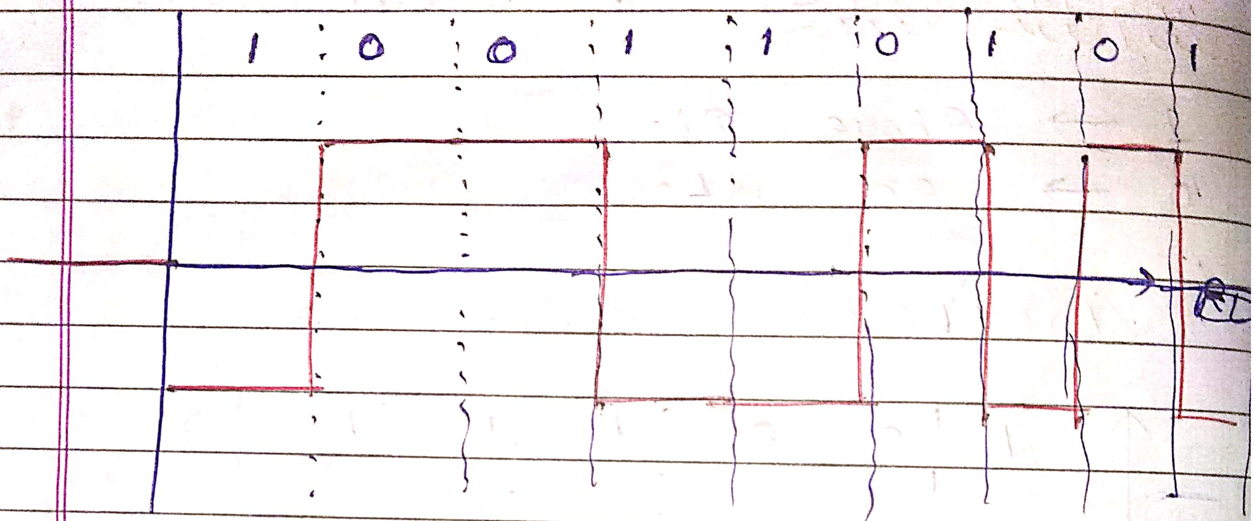
→ polar NRZ - L (Level)

→ polar NRZ - I (inverse)

(a) Polar NRZ - L :- Rule →

0 → Above RL
1 → Below RL.

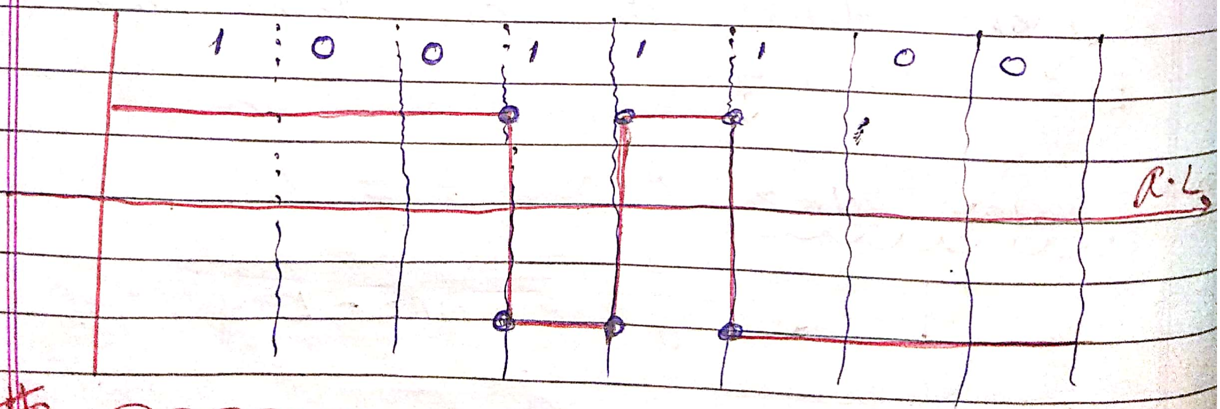
eg. digital data = 100110101.



(b) Polar NRZ - I :- Rule

0 → No transition.
1 → transition.

eg. digital data 10011100.



#to 1st bit will always be Above RL

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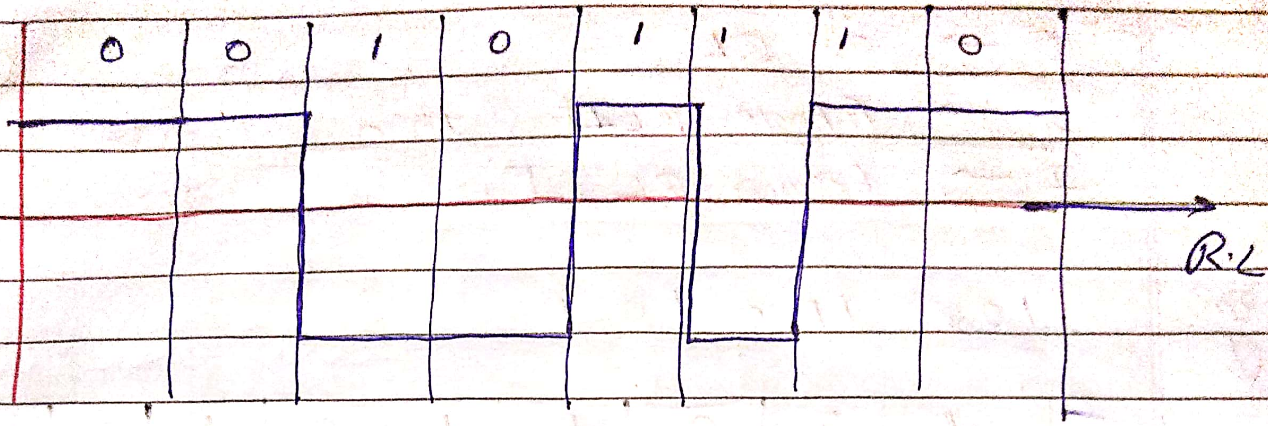
eg. 00101110

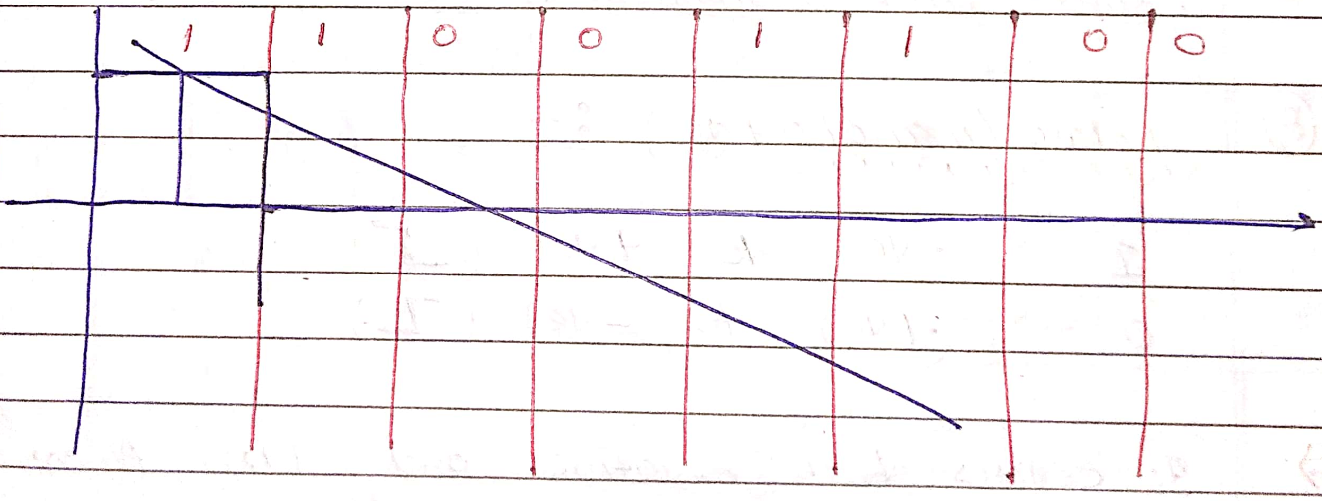


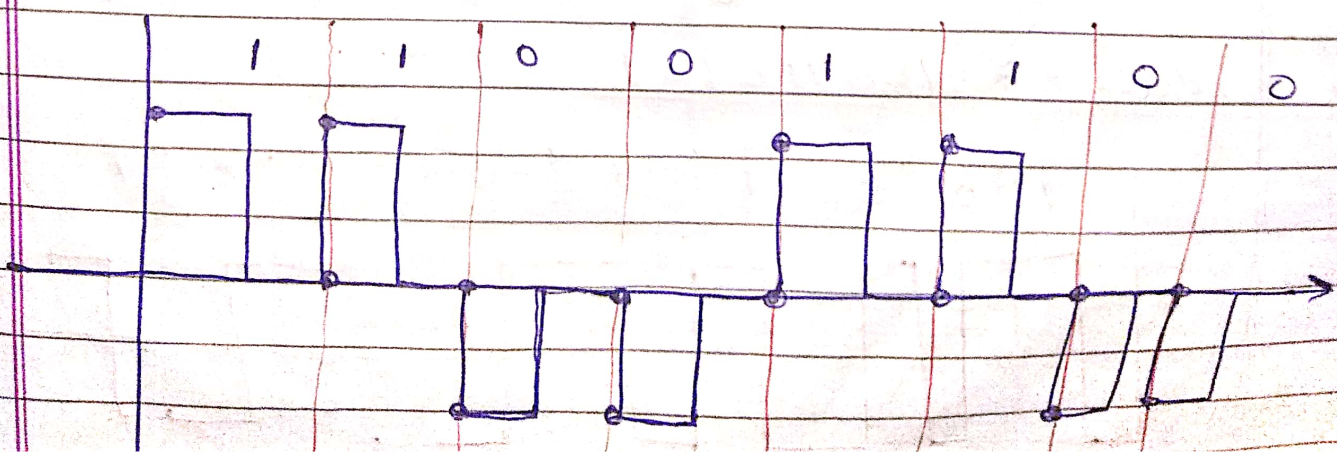
③ Polar RZ (Return to zero) :-

1 → (Above RL)

0 → (below RL)

Q 11001100





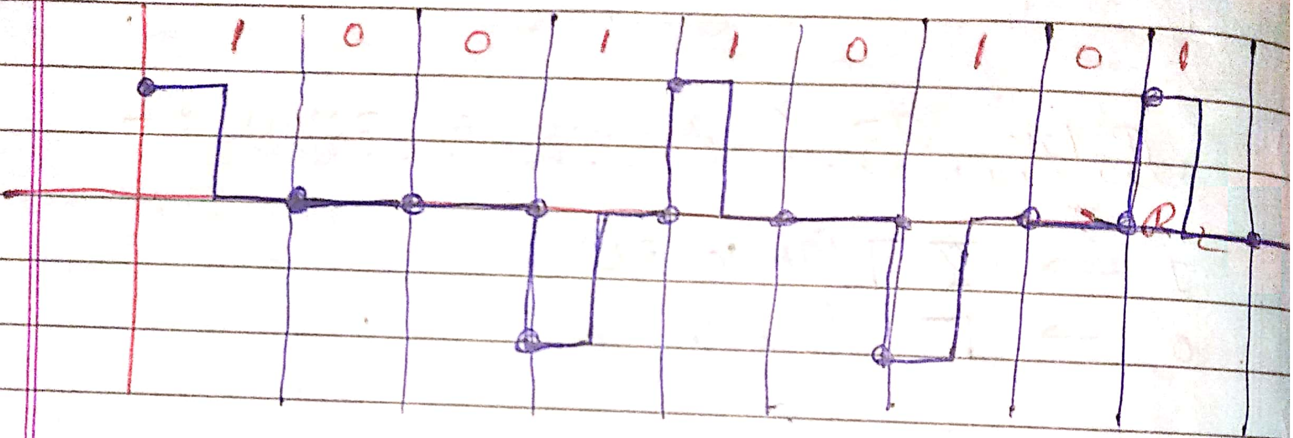
④ Bipolar RZ :-

0 → on RL

1 → Above RL (Z) and then (first)

1 → below RL (Γ) (second)

eg 100 11 0 1 0 1



→ Start with manchester.

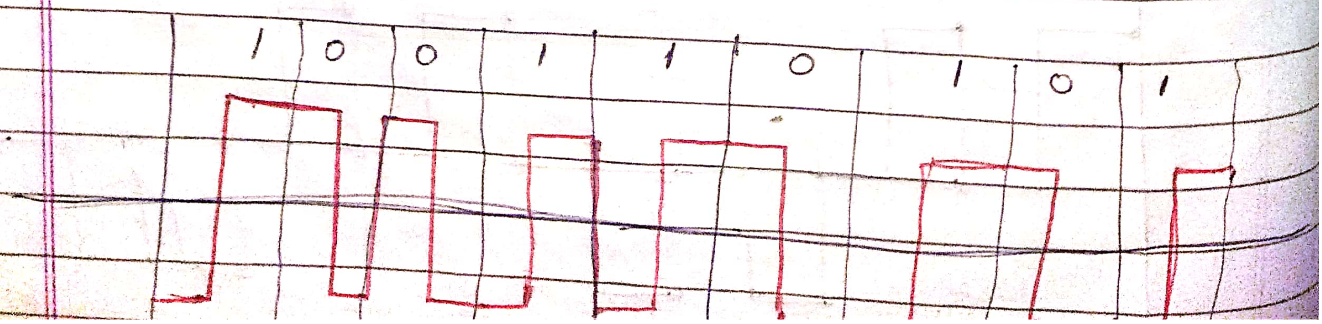
⑤ Polar (manchester) :-

1 → (-ve) to (+ve) (Γ)

0 → (+ve) to (-ve) (Z)

⇒ It covers both negative and (+ve) Axes.

eg data → 100110101



can start with any of two bit

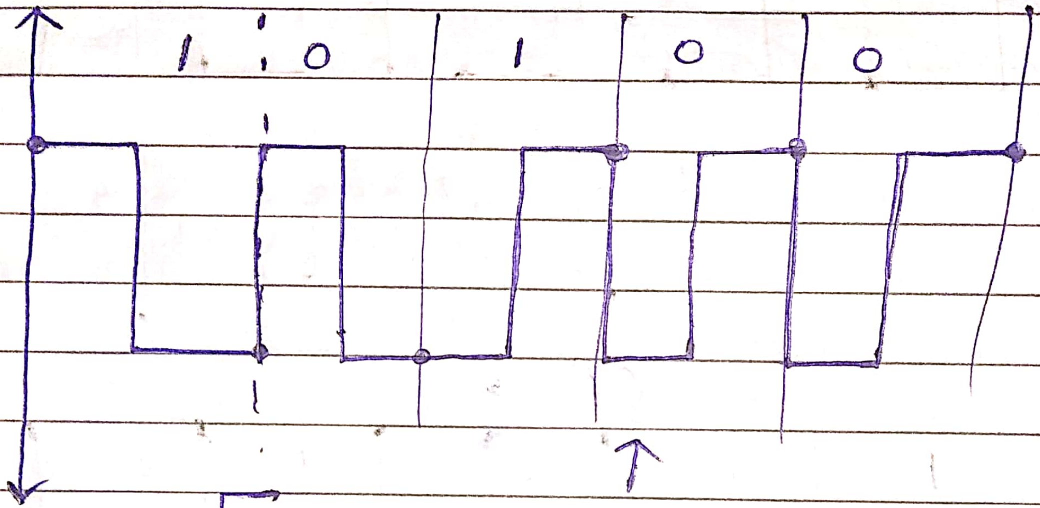
differential (Manchester)

0 → , (edge) make)

1 → , (continuous)

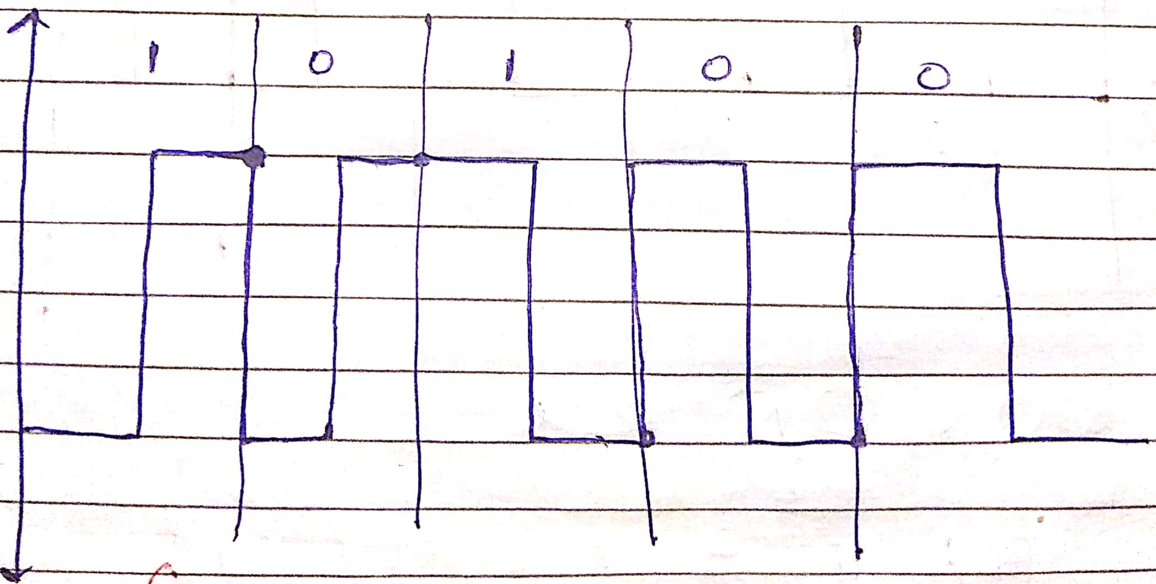
(choose best options)

10100 (don't draw R.L)



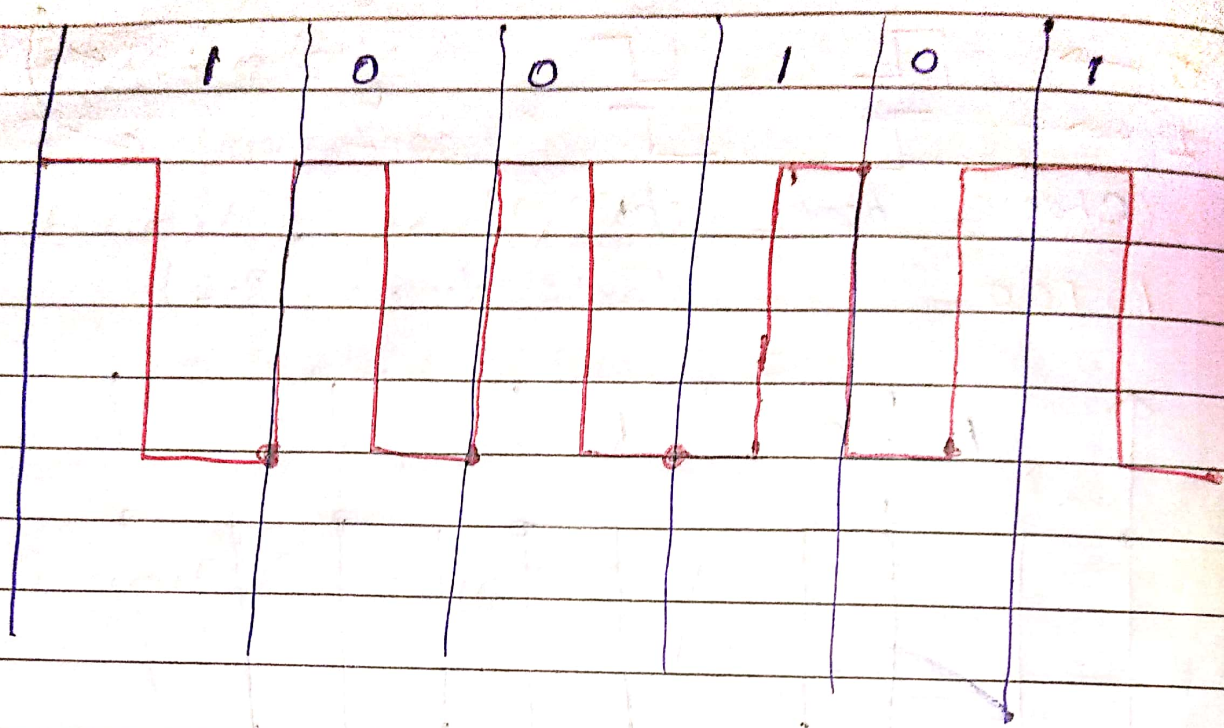
[if choosing ( ) as starting]

lets choose position as well.

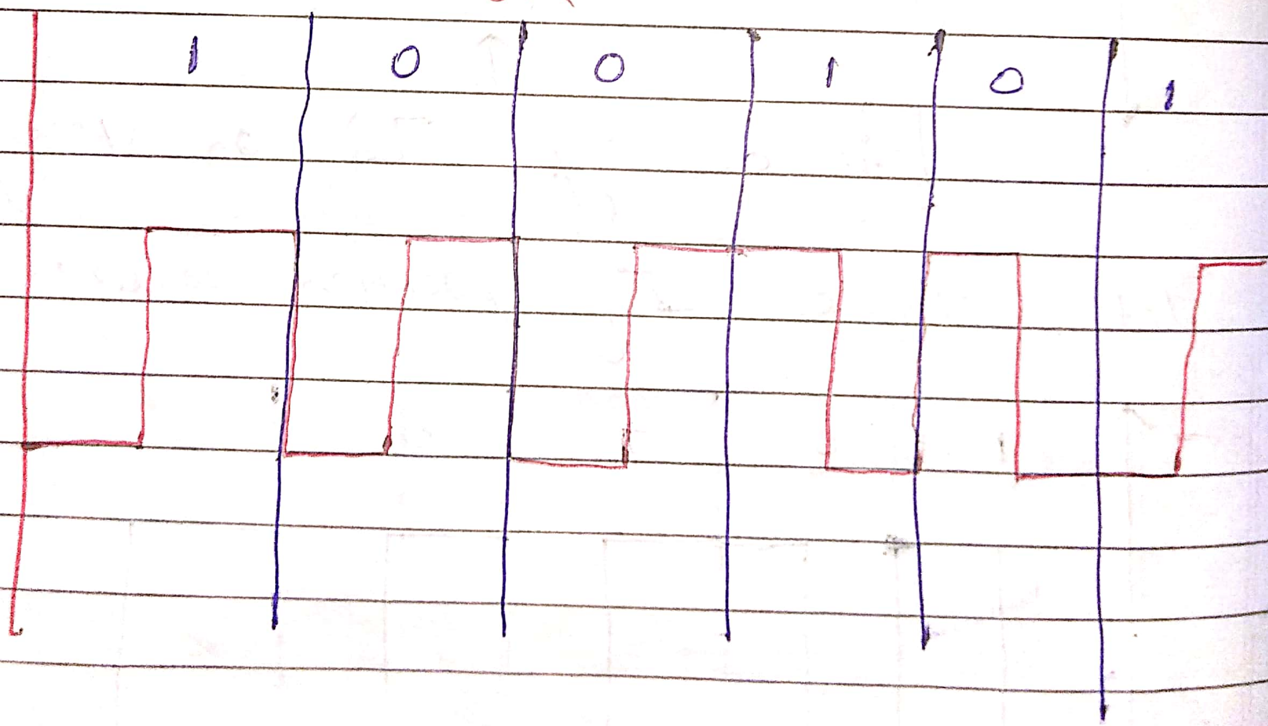


(if choosing)

eg. 1 0 0 1 0 1

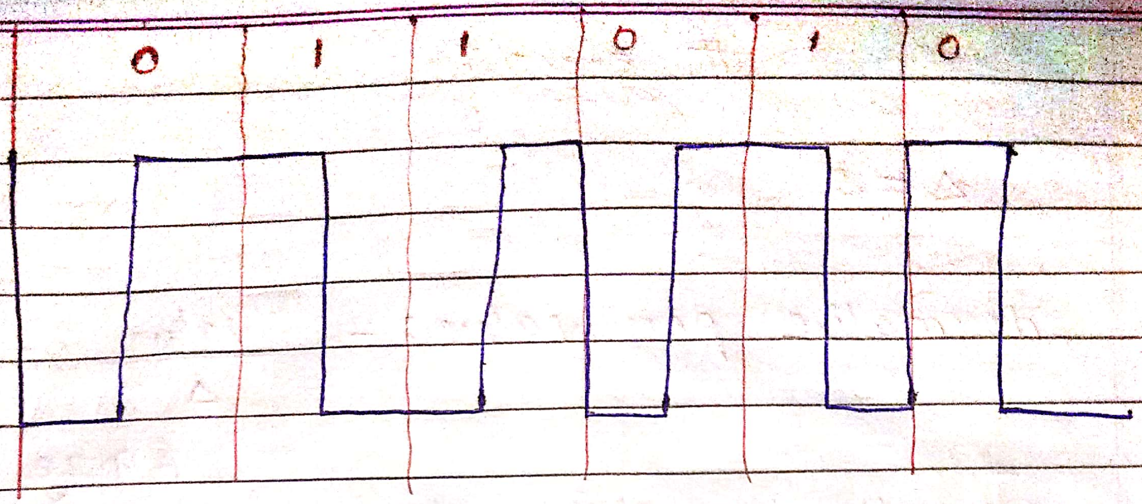


OR



eg ~~0 0 0 0 0 0 1~~

0 1 1 0 1 0



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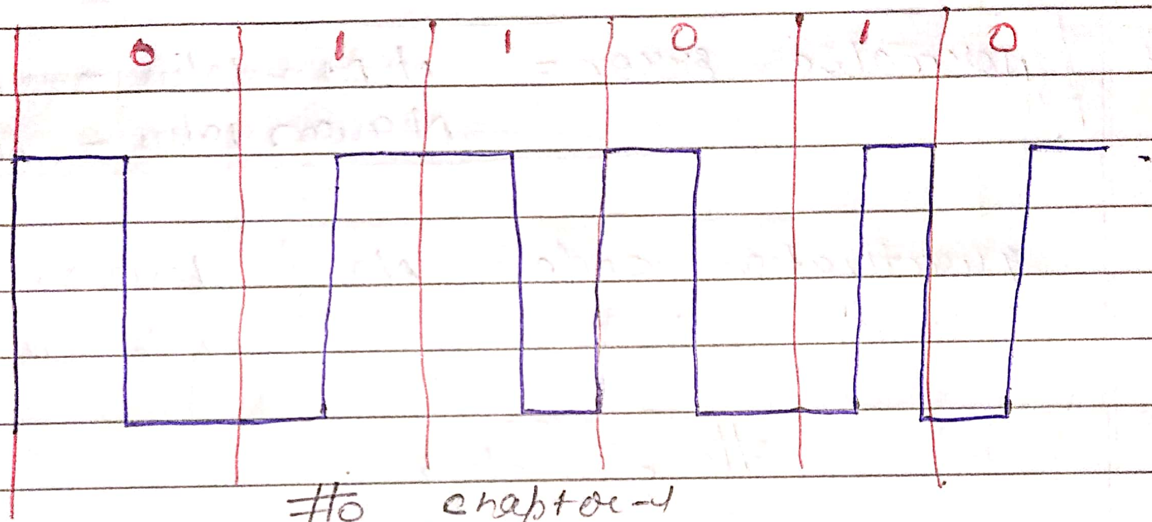
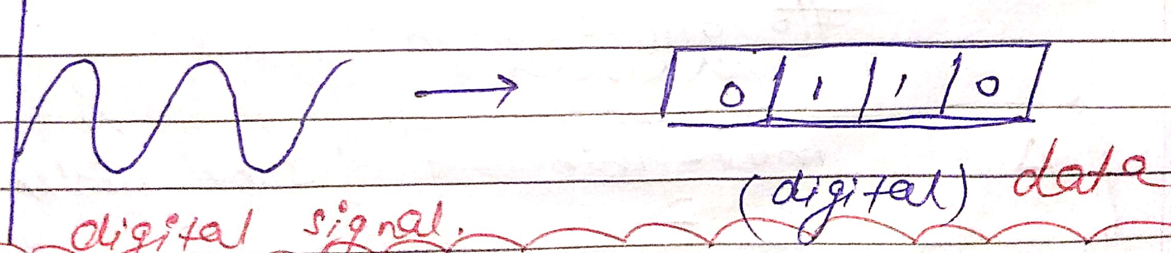


chapter-4

Imp mcq. # Analog to digital

→ process of converting Analog signal to digital data.



Analog signal → sampling → quantisation → encoding → digital data

encoding

$\Delta = 5$

① Normalise PAM value :- $\frac{\text{value}}{\Delta}$ or $\frac{\text{Value}}{\times 2}$

② Normalise quantised value = $\frac{D + 2D}{2}$ = 1.5 Range

③ $\boxed{\text{Normalise error} = \cancel{\text{N. PAM value} - \text{N. quan.}}\ \text{N. quan value} - \text{N. PAM value}}$

④ quantisation code = No. of levels.
starts with 0.

sampling

① ideal
② Natural
③ flat - top

quantisation

$\boxed{\Delta = \frac{max - min}{2}}$ (Zone width)

(S1) Calculate Δ . = $\frac{20 - (-20)}{8} = 5$

(S2) No. of level = 8 = No. of zones

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Take range → −20 to −15, −15 to −10, −10 to −5, −5 to 0, 0 to 5, 5 to 10, 10 to 15, 15 to 20

calculate midpoints $\frac{-20-15}{2} = -17.5$, $\cancel{\frac{-25}{2}}$ −12.5

and so on ------.. −17.5, −12.5, −7.5, −2.5, 2.5, 7.5, 12.5, 17.5.

Encoding

diagram :-

N. PAM Value = $\frac{\text{value}}{\Delta}$ or value × 2

N. quantized value = $\frac{D+20}{2}$ = 1.5 = $\left(\frac{\text{Range}}{2}\right)$

Normalise error = $\boxed{\text{No. quantized value} - \text{N. PAM value}}$

quantize code = No. of level (block)
level starts with 0.

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Modulate → to change

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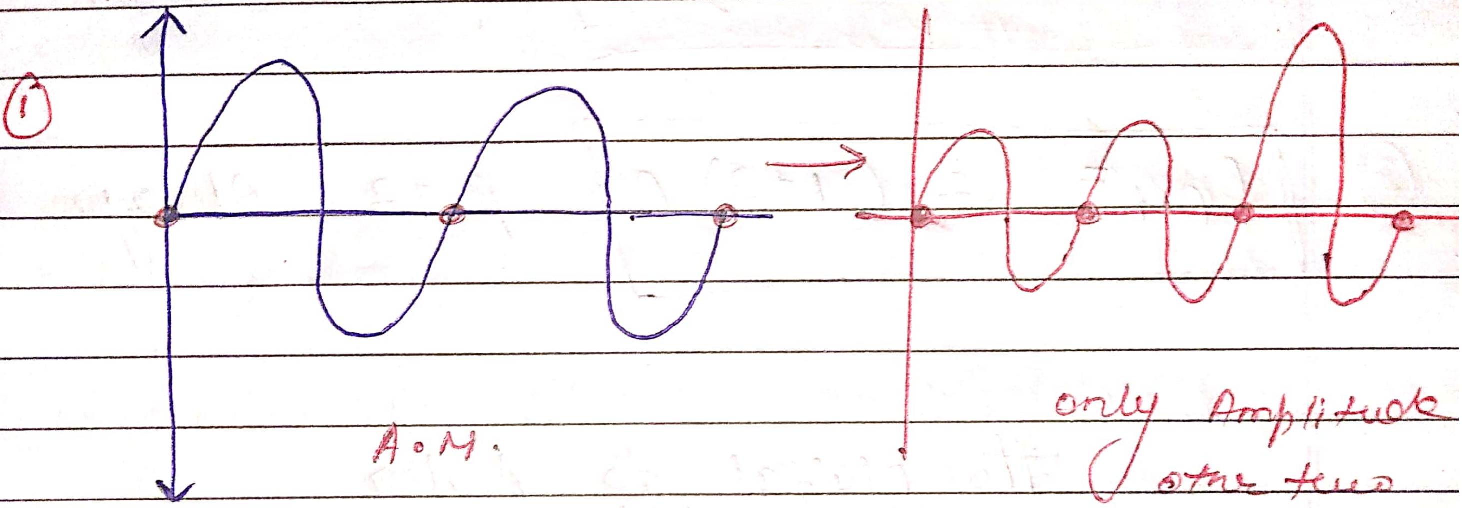
Analog to Analog

Amplitude modulation — A·M

Phase modulation — P·M

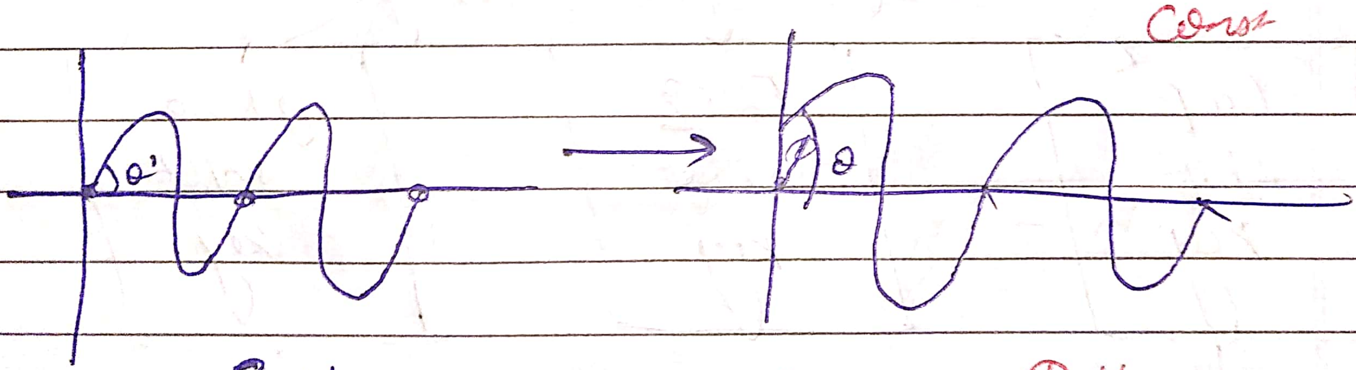
Frequency modulation — F·M

(1)

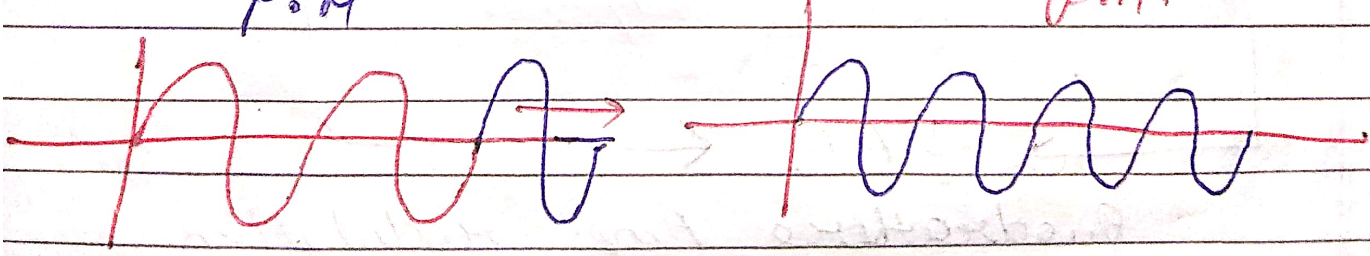


A·M.

only Amplitude
other two Const



P·M   P·M.



A·M → Amplitude change, phase and freq Constant

P·M → Phase " , Amp. & freq Con

f·M → freq " , phase & P·M Const

Note

① $\boxed{B_{AM} = 2 \cdot B}$

Bandwidth of A.M

Bandwidth

② $\boxed{B_{FM} = 2(1+\beta)B}$ $\beta = 4$ Always

③ $\boxed{B_{PM} = 2(1+\beta)B}$ $\beta = 2$ Always

Digital to Analog

Amp shift key

Freq shift key

Phase shift key.

QAM

Quadrature Amp. modulation

$\boxed{A.S.K + P.S.K = QAM}$

⇒ ① Bitrate (N) :- is the No. of bit per second

SI unit is b.p.s.

$\boxed{b.p.s}$

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Baudrate :- (S) :- It is the No. of signals sent per second.

$\boxed{\text{SI unit :- bauds.}}$

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

r = No. of data bits sent per signal element.

An Analog signal carries 4 bits per signal element, if 1000 signal elements are sent per second find bit rate.

$$S = N \times \frac{1}{r} = 1000 = N \times \frac{1}{4}$$

$N = 4000$ b.p.s Ans

formulae

Bandwidth of A.S.K = $(1+d)\,S$

$$\boxed{B_{A.S.K} = (1+d)\,S}$$

d = due to modulation and value lies betw. 0 & 1

$d \in (0,1)$.

Bandwith of F.S.K =

$$\boxed{B_{F.S.K} = (1+d)\,S + 2\Delta f}$$

$$\left\{ \Delta f = f_f - f_i \right\}$$

{diff between two freq.}

Here also → $d \in (0,1)$

③ Bandwidth of P.S.K =

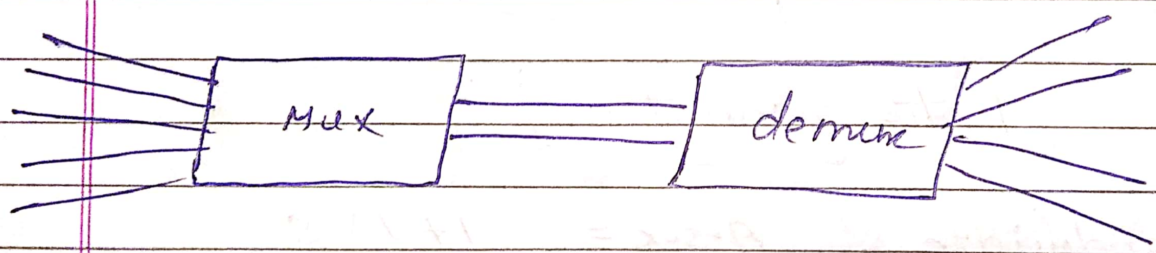
$$\boxed{B_{PSK} = (1+d) \times S}$$

but diff is $(d > 1)$

Multiplexing

⇒ Sharing of Bandwidth between multiple users

⇒ Multiplexer → Multiple I/P → 1 outp
de-multiplexer → 1 I/p → Multiple out



Muxing is of 3 types.

① T.D.M :- Time division multiplexing :-

* Here each sender is given the entire possesion of the whole bandwidth of the channel for a fixed duration of time; then the control will be given to next sender and so on.

eg:- TV serial broadcasting a 10 min serial is followed by a 5 min advertisem... and so...

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(2) F.D.M :- freq. D.M.

In F.D.M signals of diff freq are combined for concurrent transmission.

eg. Radio ~~tv~~ broadcasting diff signals at diff freq. pass through air at the same time.

(3) W.D.M :- wavelength div. multiplexing

It Increases the bandwidth by allowing different data stream schemes at diff frequencies to be sent over a single fibre optic cable.

WDM

Scanned with OKEN Scanner