Q. P. code 37358

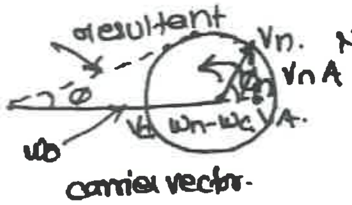
set B.

subject: Principles of Analog and Digital Commn

Q1. solve any four [5M each] [20M]

Ans a. Compare Analog and digital communication [5 points 5 marks each]

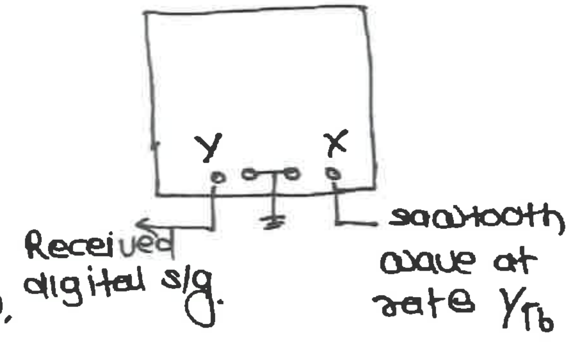
Ans b. Noise triangle explanation. [5M]



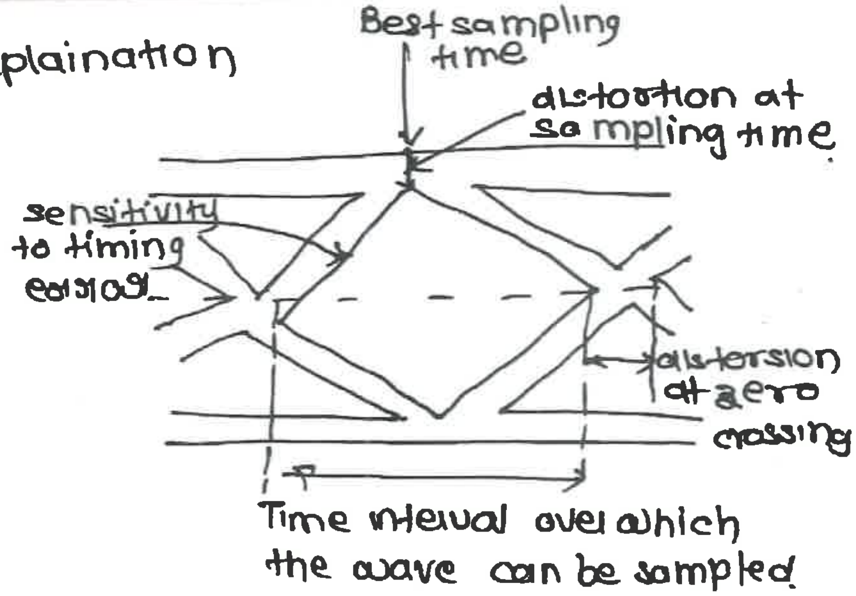
The max. deviation in amp = Vn

and max deviatn in ϕ = ϕ = $\sin^{-1}(V_n/V_c)$

Ans c. Eye pattern. Explaination

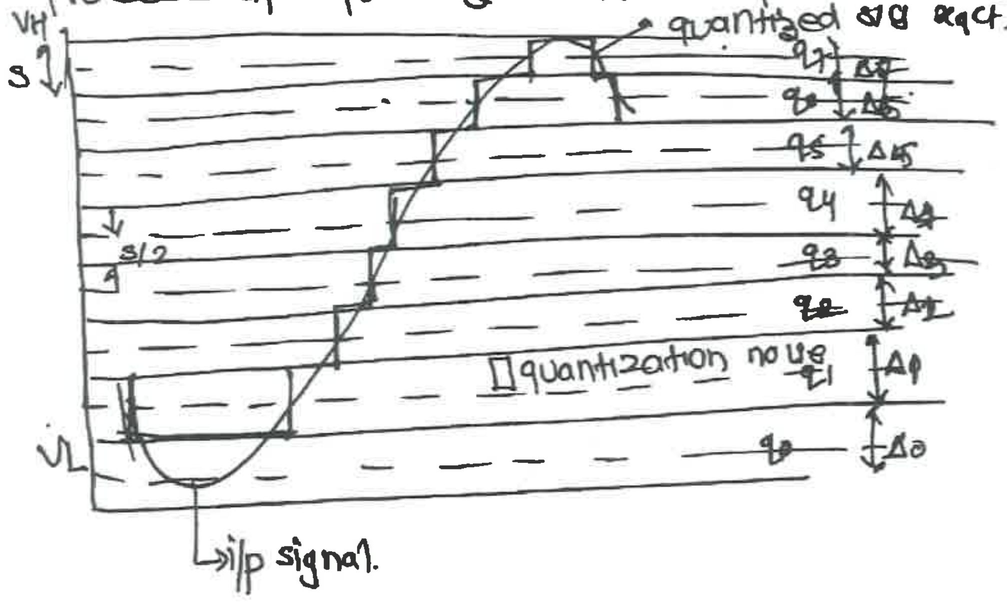


(a), Oscilloscope connection



(b) Interpretation of eye patten

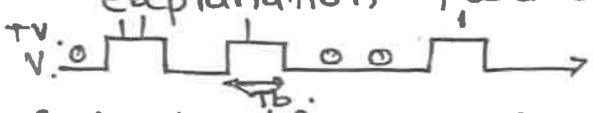
Ans d. Process of quantization. explanation [3 + 2diagm] = 5M



02

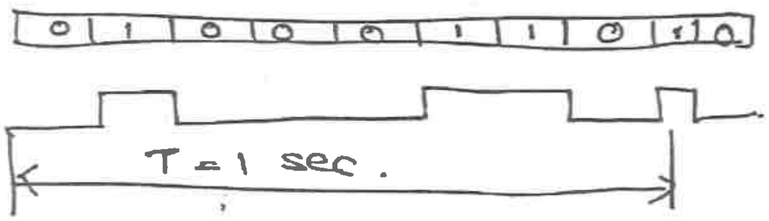
Ans e: (a) bitrate : $\frac{1}{\text{bit interval}}$.

explanation + waveform [2 ½ M]



(A bit stream)

(b) baud rate :→ explanation + waveform [2 ½ M]



Bitrate = 8 bits /sec

Baud rate = 8 bauds

Q2. (a) shot noise explanation [2½ M]

Equivalent noise temp 〃 [2½ M]

Derivation 〃 [2½ M]

The noise at the i/p of ampr is given by.

$$P_{na} = (F-1)\, k T_o B.$$

This is noise contributed by the ampr.

This noise can be alternately represented by some fictitious temp Teq.

$$P_{na} = k\, T_{eq} B$$

$$k T_{eq} B = (F-1)\, k T_o B$$

$$\therefore \boxed{T_{eq} = (F-1)\, T_o}$$

Numerical :- $F = 10 \log_{10} F$ = Anti log of (0.3) [2½ M]

$F = 1.99 \approx 2.$

$T_{eq} = (F-1)\, T_o = (2-1) \times 300 = 300^\circ K$

$\boxed{T_{eq} = 300^\circ K.}$

Q3

Que 2

Ans b :→ (1) Time shifting :- [5M]

The time shifting property states that if $x(t)$ and $X(f)$ form a FT pair then

$$x(t-t_d) \xleftrightarrow{F} e^{-j2\pi f t_d} X(f)$$

∴ Here the signal $x(t-t_d)$ is a time shifted s/g. It is the same s/g $x(t)$ only shifted in time.

Proof:
$$F(x(t-t_d)) = \int_{-\infty}^{\infty} x(t-t_d)\, e^{-j2\pi f t}\, dt.$$

Let $(t-t_d) = T$

$$\therefore t = t_d + T$$

$$dt = dT$$

$$\therefore F[x(t-t_d)] = \int_{-\infty}^{\infty} x(T)\, e^{-j2\pi f (t_d+T)}\, dT$$

$$= e^{-j2\pi f t_d} \int_{-\infty}^{\infty} x(T)\, e^{-j2\pi f t}\, dT.$$

$$F[x(t-t_d)] = e^{-j2\pi f t_d} X(f)$$

This shows that time shifting does not have any effect on the ampl. spectrum, but there is an additional phase shift of $-2\pi f t_d$. which is denoted by term $e^{-j2\pi f t_d}$.

(2) Differentiation in time domain [5M]

This property is applicable if and only if the derivative of $x(t)$ is Fourier transformable

statement :- Let $x(t) \xleftrightarrow{F} X(f)$. and let derivative of $x(t)$ be Fourier transformable.

$$\frac{d}{dt} x(t) \xleftrightarrow{F} j2\pi f X(f).$$

$$x(t) = \int_{-\infty}^{\infty} X(f)\, e^{+j2\pi ft}\, df$$

$$\therefore \frac{d}{dt} x(t) = \frac{d}{dt}\left[\int_{-\infty}^{\infty} X(f)\, e^{-j2\pi ft}\, df\right] = \int_{-\infty}^{\infty} X(f) \left(\frac{d}{dt} e^{j2\pi ft}\right) df$$

$$\frac{d}{dt} x(t) = \int_{-\infty}^{\infty} [X(f) \cdot j2\pi f)\, e^{+j2\pi ft}\, df.$$

As per the defn of the inverse F·T the term inside the sq. bracket must be the FT of $\frac{d}{dt}x(t)$

$$\therefore F\left[\frac{d}{dt} x(t)\right] = j2\pi f X(f)$$

OR $\frac{d}{dt} x(t) \xleftrightarrow{F} j2\pi f X(f)$.

Q3.(a) $P_c = 400\,W$, $R_L = 50\,\Omega$ $m = 0.8$, $f_m = 5\,kHz$,

$f_c = 1\,MHz$

(1) carrier amplitude V_c.

$\therefore$ The carrier power $P_c = \frac{V_c^2}{2R_L}$

$V_c = \sqrt{2R_LP_c} = \sqrt{2 \times 50 \times 400} = 200$ volts.

(2) Expression for AM wave

$$e_{AM} = E_c\,[1 + m\cos(2\pi f_m t)]\cos(2\pi f_c t)$$

$E_c = 200V$ $m = 0.8$ $f_m = 5\,KHz$ $f_c = 1\,MHz$

$$e_{AM} = 200\,[1 + 0.8\cos(2\pi \times 5 \times 10^3\, t)]\cos(2\pi \times 1 \times 10^6\, t)]$$

$$e_{AM} = 200\,[1 + 0.8\cos(10^4 \pi t)]\cos(2\pi \times 10^6\, t)]$$

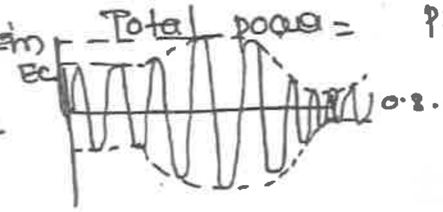
(3) $P_{USB} = P_{LS} = \frac{m^2}{4} \times P_c = \frac{0.8^2}{4} \times 400 = 64\,W.$

$\therefore$ Total sideband power $= 64W + 64W = 128\,W$.

Total power $= P_t = P_c + P_{USB} + P_{LSB}$

$= 400 + 64 + 64 = 528\,W$.

AM wave:-



05

Q3. ③

Ans b. Drawbacks of TRF-

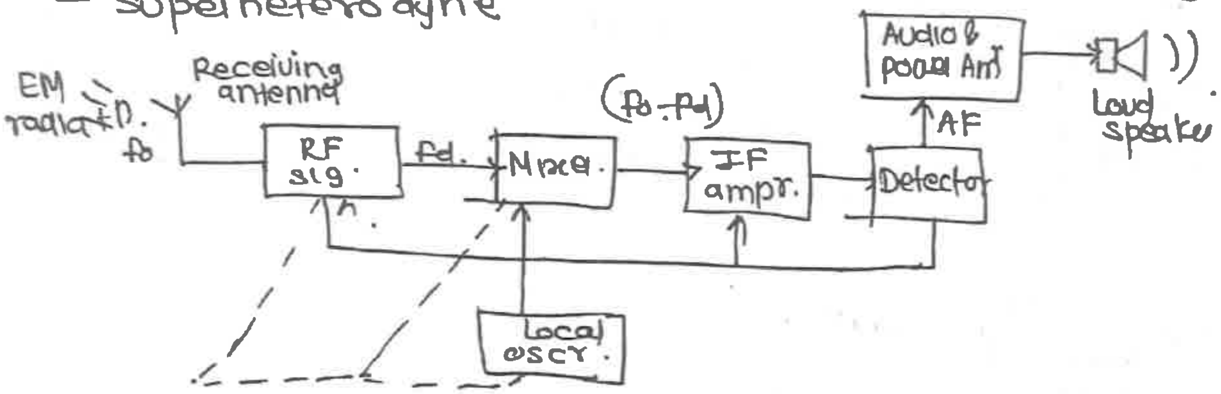
[3M]

(1) Instability -
(2) Variation in BW over the tuning range
(3) Insufficient selectivity at high frequencies and poor adjacent channel rejection.

Explanation in short^n.

[7M]

- superheterodyne

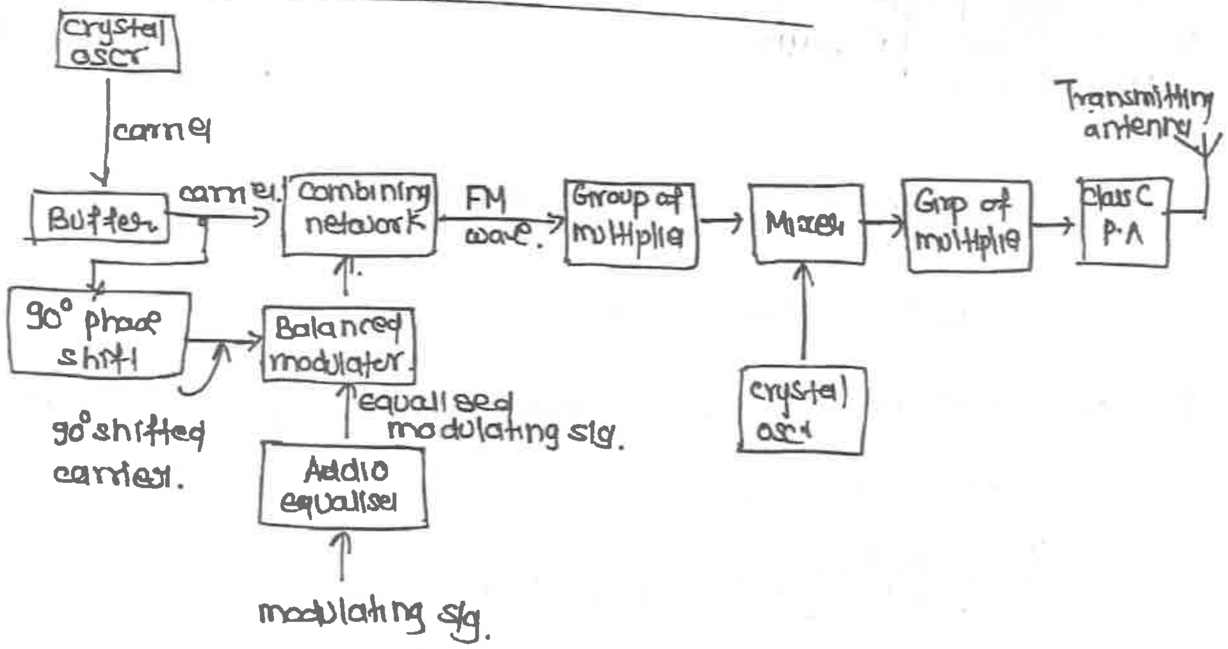


ganged tuning.

operation in detail:

Q.4.

Ans (a) Indirect Mthd of FM generation:



block diagram + explanation of each block

[3 + 7 M = 10 M]

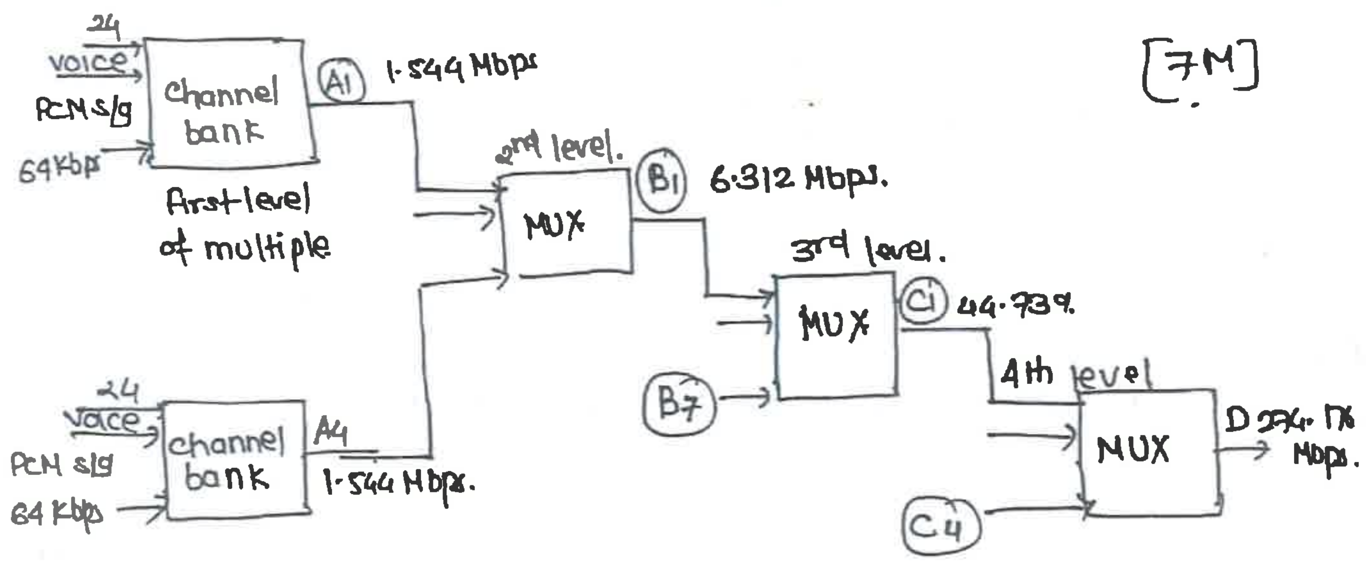
06

Ans 4.b Defn of multiplexing [1M]

Multiplexing hierarchy [2M]

level.	AT and T.		CCIT	
	No of i/ps	o/p rate Mb/s.	No of i/ps	o/p rate Mb/s
First	24	1.544	30	2.048
second	4	6.312	4	8.448
third	7	44.736	4	34.368
Fourth	6	274.176	4	139.264

[7M]

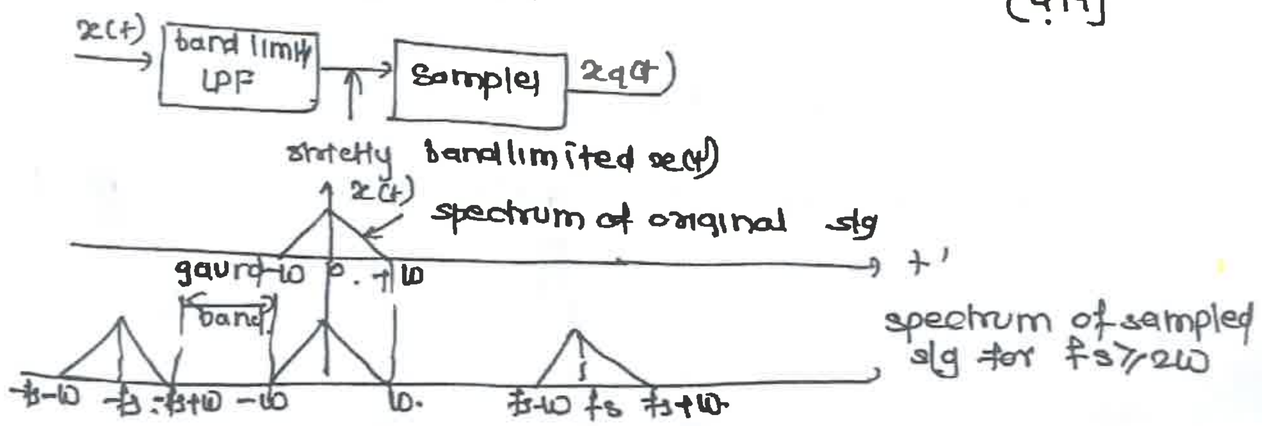


Multiplexing hierarchy for digital commn.

and explanation.

Qs. 9. statement of sampling theorem [2M]

Anti aliasing filter [4M]



07

(4)

(b) $f_1 = 20\,kHz$ $f_2 = 82\,kHz$. [4M]

BW $B = f_2 - f_1 = 82 - 20 = 62\,kHz$ —— (1)

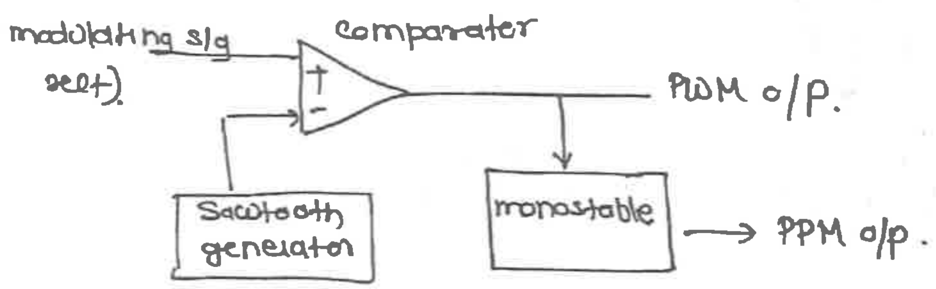
Let us assume $f_s = 2B = 2 \times 62 = 124\,kHz$ —— (2)

from eqn (1) and (2) we observe that neither f_1 nor f_2 is harmonically related to f_s. Hence we have to use the general bandpass sampling theorem ~~stated in preceeding eq~~

$$K = \frac{f_m}{B} = \frac{82}{62} = 1.32.$$

$$f_s = \frac{2 f_m}{K} = \frac{2 \times 82}{1} = 164\,kHz.$$

Ans C. PWM generation. with working

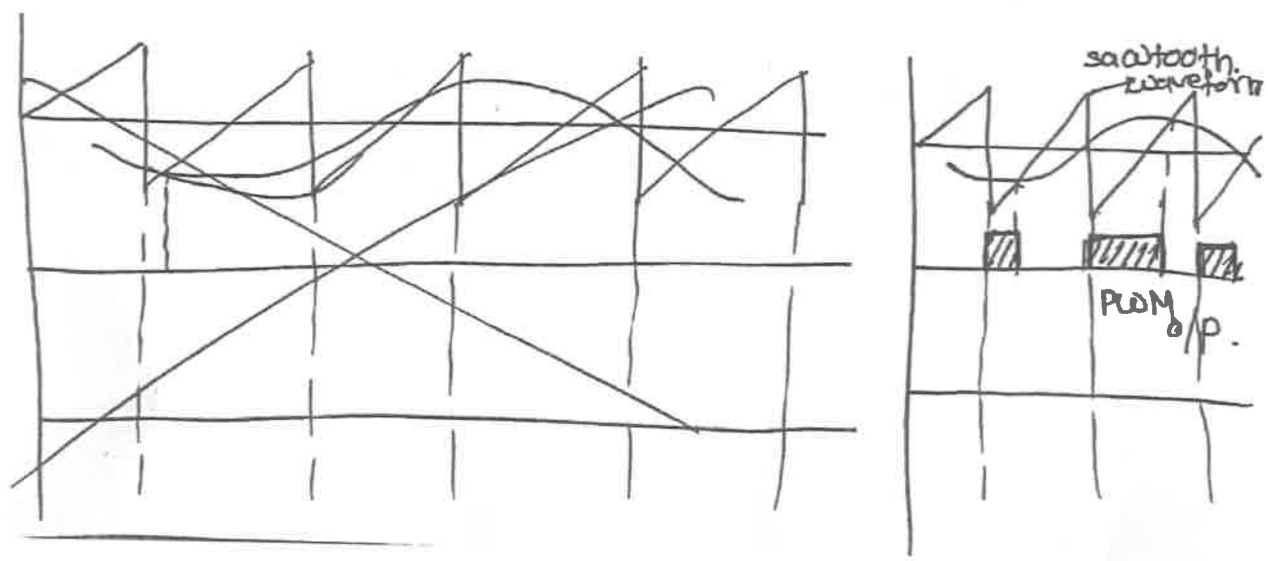


[2M]

PWM generator

operation and exploration. → [5M]

waveform → [3M]



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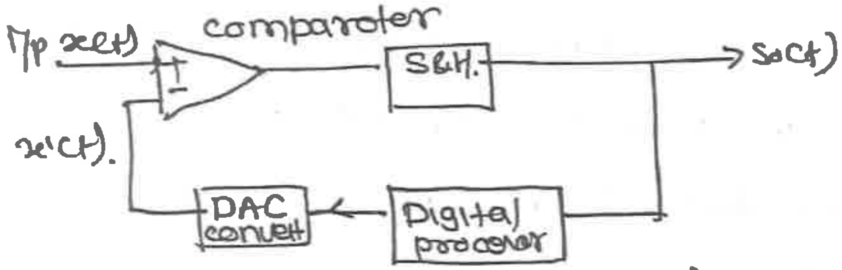
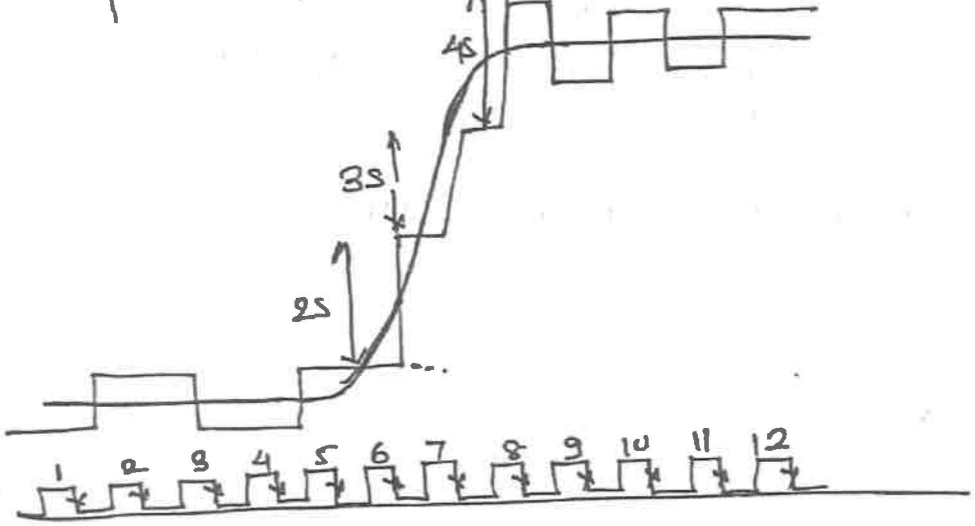
Ques 6

(a) Explanation for how ADM is better than Linear delta modulation. [2M]

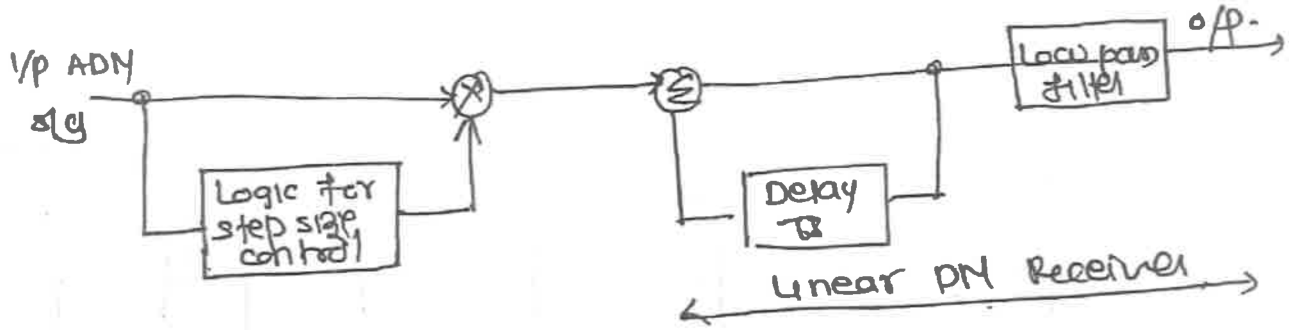
ADM transmitter [6+2M]



operation :- and waveform :-



ADM Receiver :-



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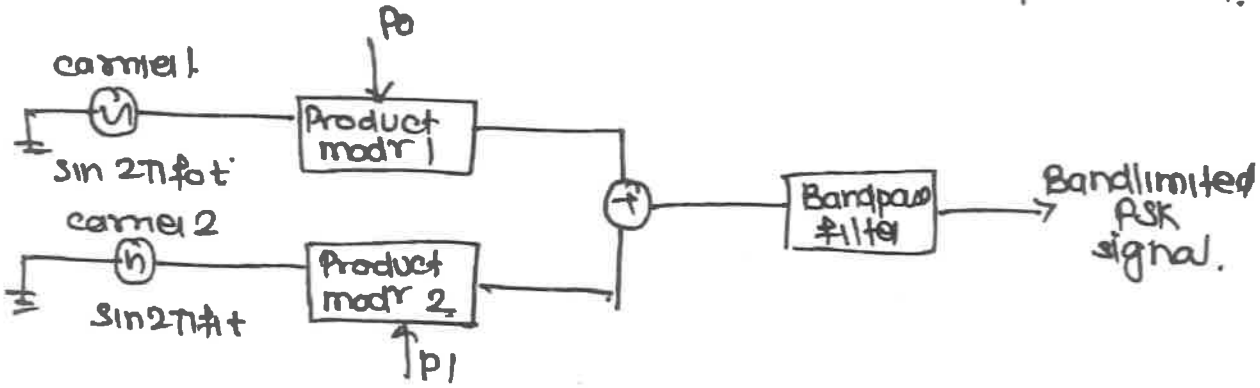
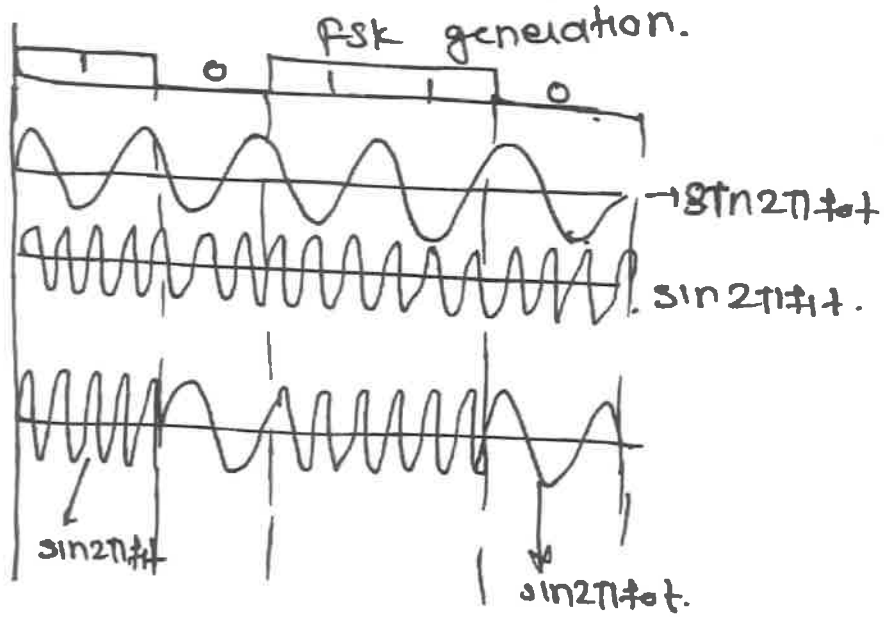
5

Ans 6. b. fsk generation 5 Marks Reception 5 M.

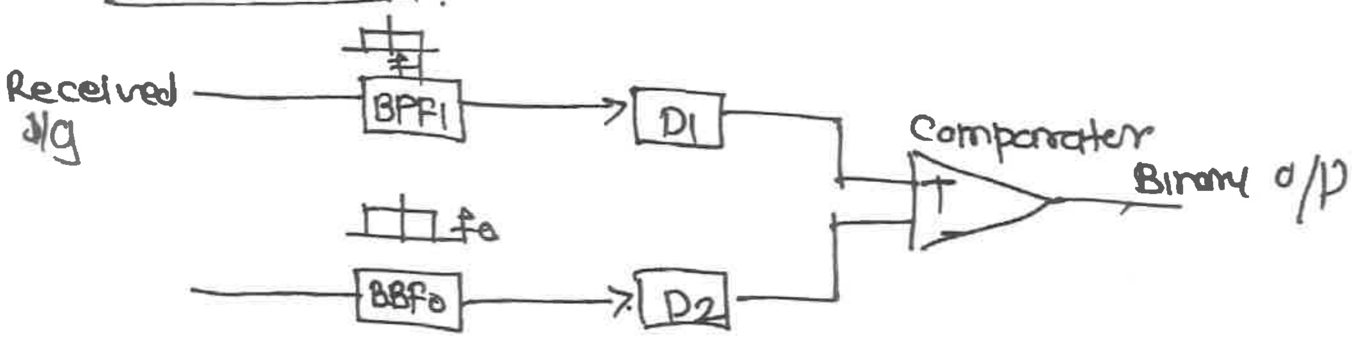


fsk generation.



FSK waveform.

fsk receiver.



with explanation