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Sec B. Roll 16

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1)  $\beta = 2$

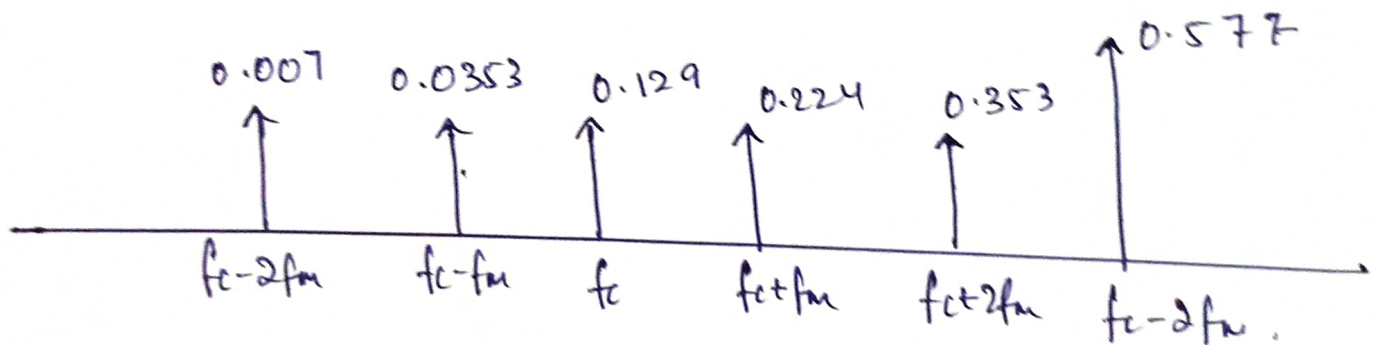
$A_c = 3$

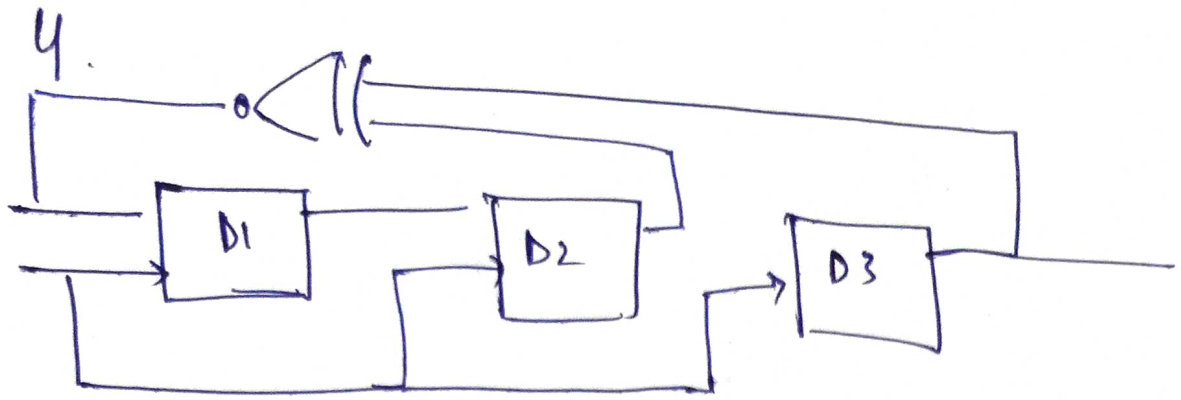
from table,

$$(0.224)^2 + 3(0.577)^2 + 3(0.353)^2 + 3(0.129)^2 \\ + 3(0.034)^2 + 3(0.007)^2$$

$$= 1.476 > 0.93.$$

$\beta = 2$  will have 3 sidebands.



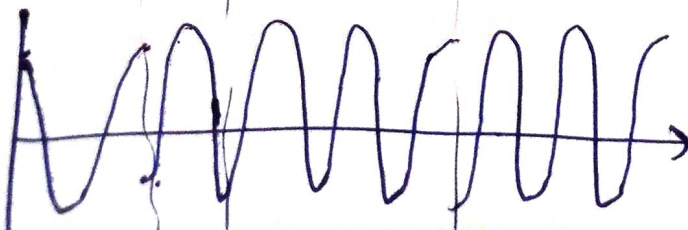
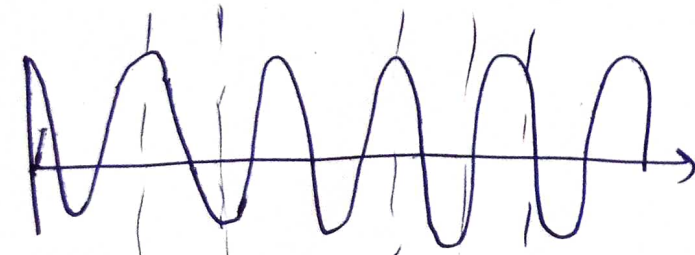
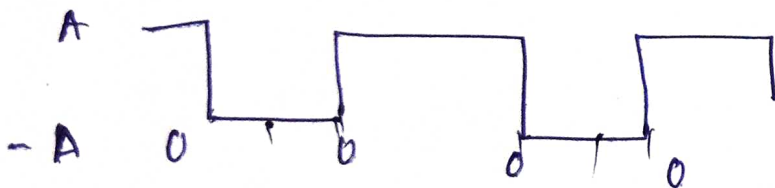


Clock	S1	S2	S3	PN
↑	1	0	1	1
↑	1	1	0	0
↑	1	1	1	1
↑	0	1	1	1
↑	0	0	1	0
↑	1	0	0	0
↑	0	1	0	0
↑	1	0	1	1

$$M = 3$$

$$2^M - 1 = 7$$

$$PN(seq) = 11111001$$



6) Case 1.

$$\begin{aligned} y(t) &= \int_{-\infty}^{\infty} h(\tau) g(t-\tau) d\tau. \\ &= \int_0^t 9 d\tau = 9t \end{aligned}$$

Case 2.

$$-1+t \leq 3 \quad \& \quad t > 3.$$

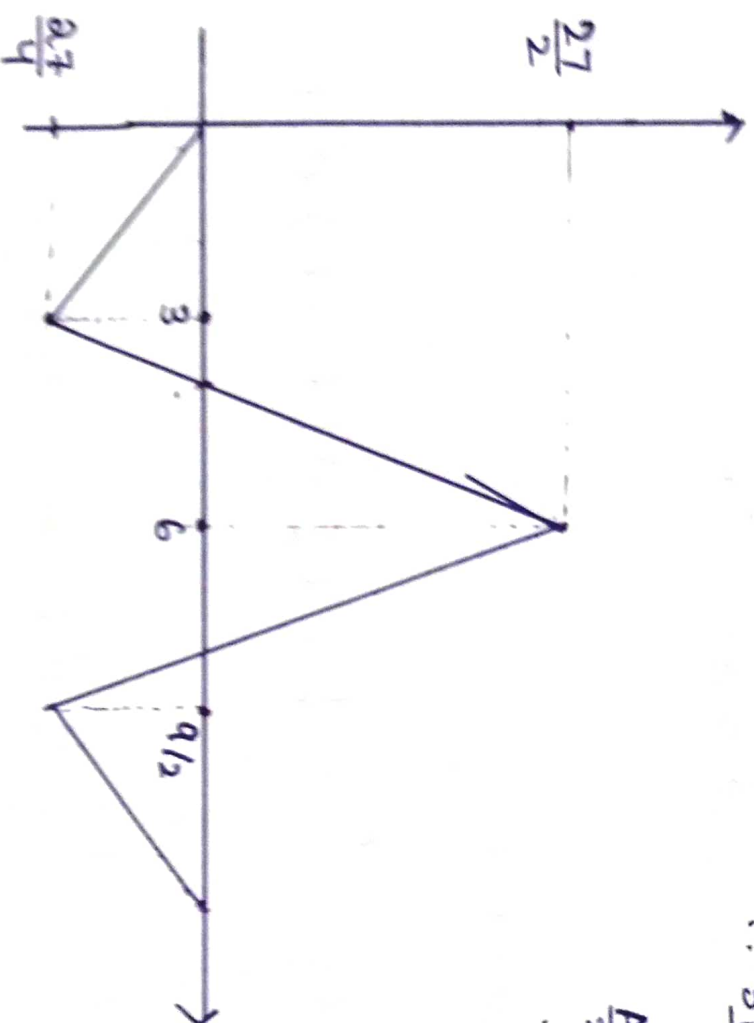
$$\Rightarrow \int_{-1+t}^3 -9 d\tau + \int_3^{-3+t} 9 d\tau + \int_{-3+t}^t -9 d\tau.$$

$$\begin{aligned} &= -9(3) + 9(-6+t) + 9(-3+t) - 27 \\ &\quad - 9t + 9(-3+t) \\ &= 13t - 162. \end{aligned}$$

Case 3.  $-6+t > 3 \quad \& \quad t > 6.$

$$\begin{aligned} \int_{-6+t}^6 9 d\tau &= 54 - 9(-6+t). \\ &= 108 - 9t \end{aligned}$$

6. Impulse response of matched filter  
is  $h(t) = s(T-t)$



$$\begin{aligned} I_2 &= 3 \\ T &= 6 \\ \therefore \frac{3(6)^3}{4} &= \frac{9}{2} \end{aligned}$$

$$\frac{A}{2} = 3$$

$$\therefore A^2 \cdot \frac{T}{4} = \frac{9 \times 6^3}{4}$$

$$= \frac{27}{2}$$

$$A^2 \cdot \frac{T}{8} = \frac{9 \times 6^3}{8}$$

output of matched filter is obtained by convolving  $h(t)$  and  $s(t)$ .

Tushar

2b.

binary data rate = 30 kbps

required bandwidth of M array PSK is,

$$B_w = \frac{2R_b}{n}$$

$$2^n = M, R_b = \text{bit rate}$$

for BPSK,  $n = 1$ .

$$\Rightarrow M = 2$$

$$\therefore B_1 = \frac{2 \times 30}{1} = 2 \times 30 = 60 \text{ kHz}$$

for ~~BPSK~~ QPSK,  $n = 2$   
 $M = 4$ .

$$B = \frac{2 \times 30}{2} = 30 \text{ kHz}$$

2a.

$$3. \quad r = \frac{1}{2}$$

Irish

$$\Rightarrow n = 2$$

$$k = 4$$

$$M = 3.$$

a) path 1 has 4 connections,

$$g^1(D) = 1 + D + D^2 + D^3$$

path 2 has 1011 connected.

$$g^2(D) = 1 + D^2 + D^3.$$

b). We know,  $C^1(D) = M(D) * g^1(D)$

$$M(D) = 1 + D^2 + D^3 + D^4.$$

$$\therefore C^1(D) = (1 + D^2 + D^3 + D^4) (1 + D + D^2 + D^3)$$

$$= 1 + D + D^7$$

$$C^1 = [1 \ 1 \ 0 \ 0 \ 0 \ 0 \ 0 \ 1]$$

Similarly,  $C^2(D) = M(D) * g^2(D)$

$$= (1 + D^2 + D^3 + D^4) (1 + D^2 + D^3)$$

$$= 1 + D^7$$

$$C^2 = [1 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 1]$$

$$\therefore C^* = [11, 10, 00, 00, 00, 00, 00, 11]$$

ans

Trishu

2a.

$b_k$       0      1      0      1      0      £

$d_k$     1    0      0      1      1      0

Q/p  $\rightarrow$     0    1    1      0      0      0 1

$b_k$		0	1	0	1	0
$d_{k-1}$		0	1	1	0	0
$d_k$	<span style="border: 1px solid black; padding: 0 2px;">1</span>	0	0	1	1	0

xnor  $b_k$  &  $d_{k-1}$ .

ans: 0, 1, 1, 0, 0.

$\Rightarrow$  0 1 1 0 0

6

$$\text{case 4} \quad -6 < t < 6 \quad 7 < t < 6$$

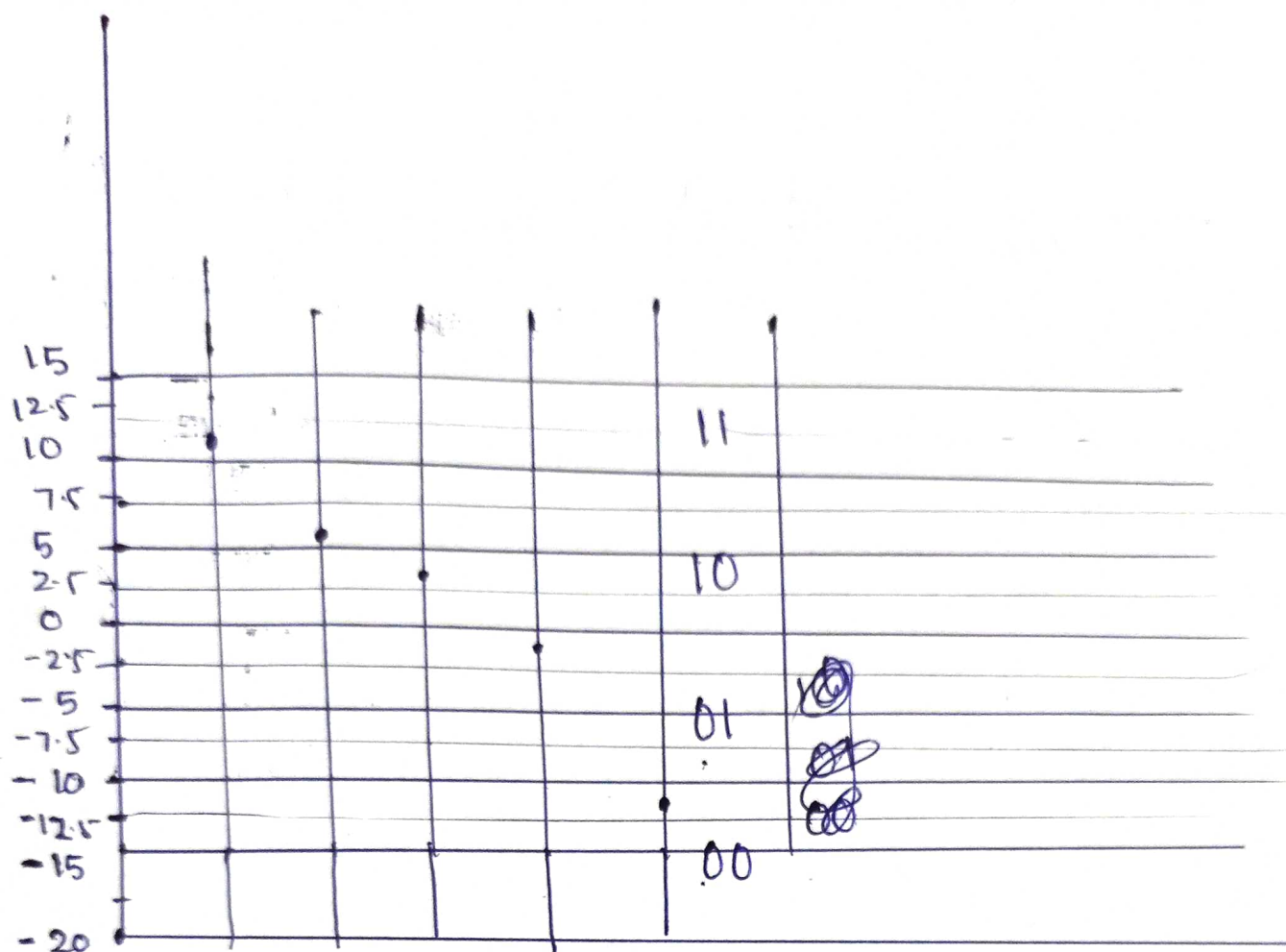
$$y(t) = 0$$

$$y(t) = \begin{cases} 0 & t < 0 \\ 9t & 0 \leq t < 7 \\ 13t - 102 & 7 \leq t < 9 \\ 10t - 91 & 9 \leq t < 12 \\ 0 & t \geq 12 \end{cases}$$



6 case 4  $-6 + t > 6 \text{ \& } t > 6$   
 $y(t) = 0$

$$y(t) = \begin{cases} 0 & t < 0 \\ 9t & 0 < t \leq 3 \\ 13t - 162 & 3t \leq 9 \\ 108 - 9t & 9 \leq t \\ 0 & t > 12 \end{cases}$$



$$11.3 = 11$$

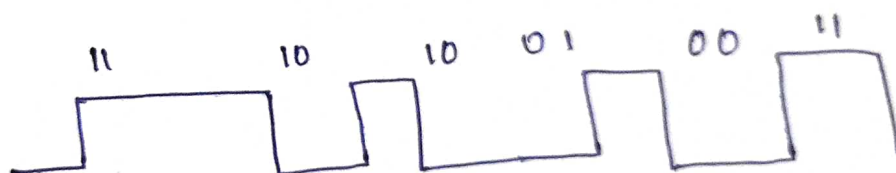
$$5.6 = 10$$

$$7.7 = 10$$

$$-1.7 = 01$$

$$-12.4 = 00$$

$$13.4 = 11$$



$$g(t) = 10 \cos(220\pi t) \cos(200\pi t)$$

$$\textcircled{2} = 5 \cos 220\pi t + \cos 180\pi t$$

$$\omega = 220\pi$$

$$\Rightarrow f_m = 110\text{Hz}$$

$$G(f) = 5/2 \{ \delta(f-100) + \delta(f+100) + \delta(f-100) \}$$

