Name: Iqbal Hussain

Id: 13690

Q:1 (a)

Ans:

Sol:

Signal = $x(t)$

f_m = 250HZ

angular frequency = fs

Nyquist rate =

NR = ?

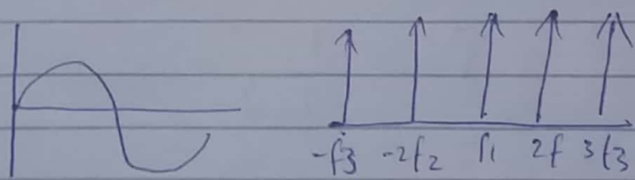
NR > $2f_m$ ∵ f_m = 250

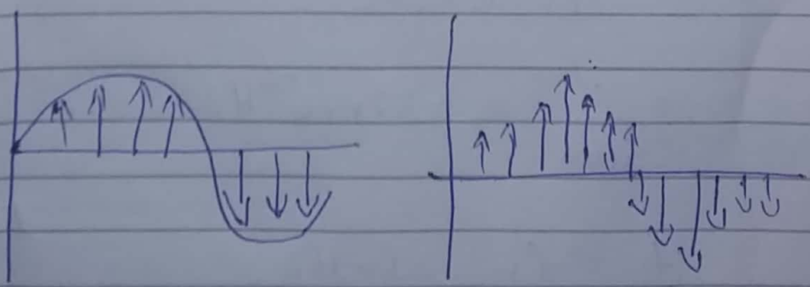
NR > 2×250

NR > 500 = 500HZ

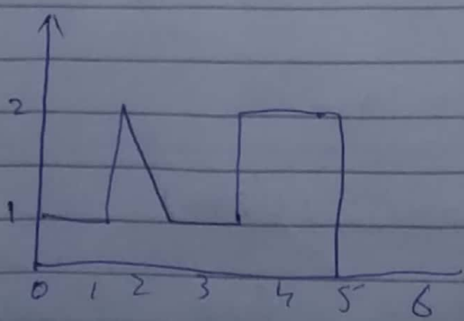
(b)

$x(t)$





$x(t)$



$$x(t) = u(t) + r(t-1) - 2r(t-2) + r(t-3) + u(t-4) - 2u(t-5)$$

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$x(2) = u(2) + r(1) - 2(0) + r(-1) + u(-2) - 2u(-3)$

$= 1 + 1 = 2$

$x(5) = u(5) + r(4) - 2r(3) + r(2) + u(1) - 2u(0)$

$= -1 + 4 - 2.3 + 2 + 2 + 1 - 2.1$

$= 3.6$

(c) Cut off frequency

$$f_c = \frac{1}{2\pi CR}$$

$$= \frac{1}{2 \times 3.14 \times 500}$$

$$= \frac{1}{3100} = 0.32 \times 10^{-6} \, HZ$$

(d) $f_m = 250\,HZ$

$f_s = 800\,HZ$

As we know that

$f_s = 2f_m$

so

$800 = 2(250)$

$800 = 500$

so

$f_s > f_m$

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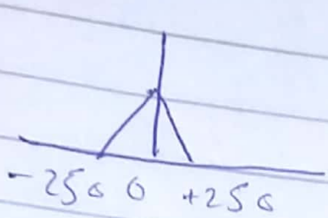
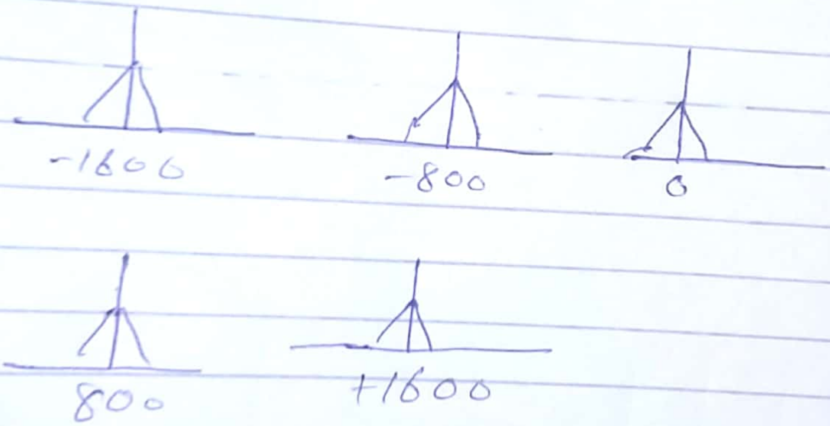


the resulting sampled signal is



Q:2 (a)

Ans

(i) $x(t) + x(t-1)$

Sol:

$$m(t) = x(t) + x(t-1)$$

$NR = ?$

$x(t) \Rightarrow NR = ws$

$x(t) \xrightarrow{\text{Time shifting}} x(t-1)$

(i) (ii)

(i) and ii are same nyquist rate.

message$(t) = x(t) + x(t-1)$

$NR = ws$ ws   ws

(ii) $dx(t)/dt$

Sol. $m(t) = dx(t)/dt$

$x(t)$ and dt are same nyquist rate so this is the answer.

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Q:2 b

Ans:

Solution:

$m(t) = 10 \sin 400 \pi t$

$\omega_m = 400\pi$ rad/sec

$f_m = \frac{\omega_m}{2\pi} = \frac{400\pi}{2\pi}$ 200 HZ

frequency components of y(t)

1st we calculate sample freq by formula. $nfs \pm fm$

put different value of n

n = 0

$fs \pm fm = 0 \pm fm = \pm fm = \pm 200 HZ$

n = 1

$\Rightarrow fs \pm fm = 1fs \pm fm =$
→ $1fs + fm = 300 + 200 = 500 HZ$
→ $1fs - fm = 300 - 200 = 100 HZ$

n = -1

$\Rightarrow fs \pm fm$
→ $-fs + fm = -300 + 200 = -100 HZ$
→ $-fs - fm = -300 - 200 = -500 HZ$

the out of frequency is 150 so The freq Range from -150HZ to +150 will pass into output.

So freq 100HZ & -100HZ is in range. so 100HZ will be component of output.

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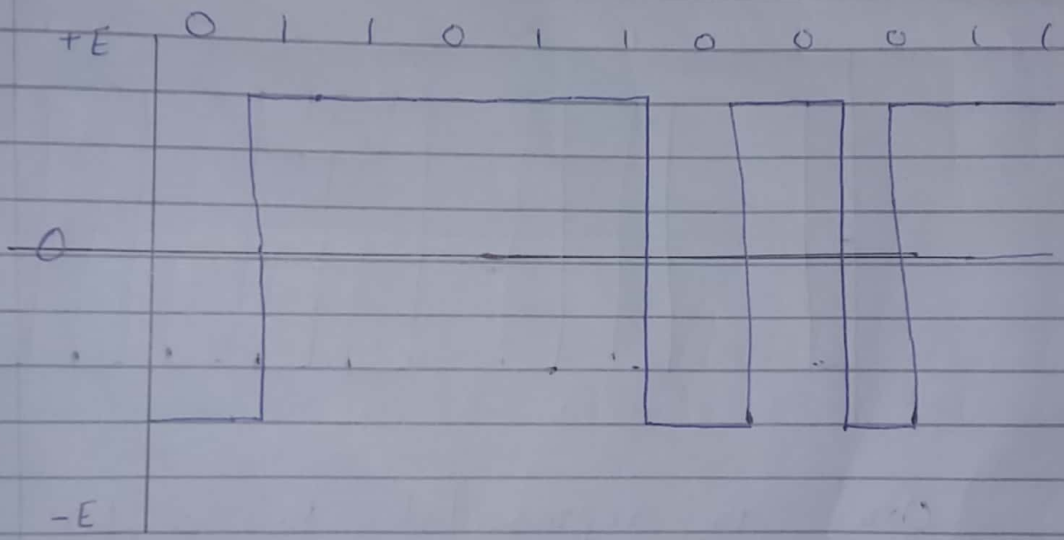
Q:3

Ans: (a) NRZ - S PCM waveform
(0 1 1 0 1 1 0 0 0 1 1)

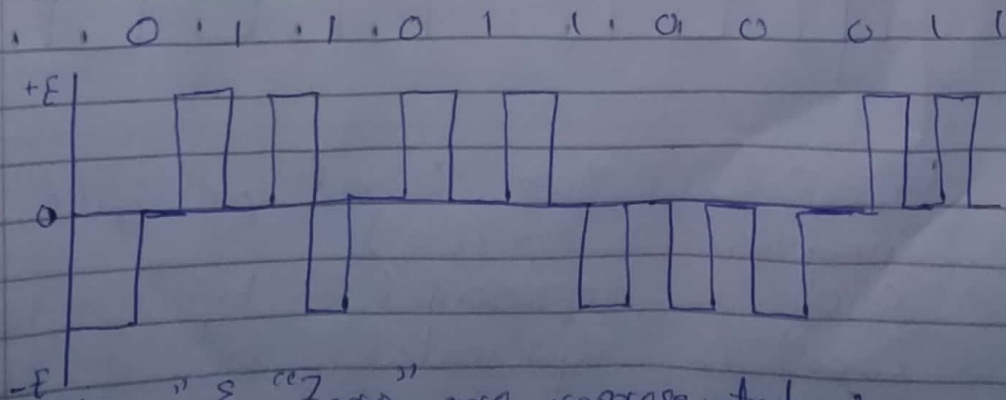


NRZ Space (NRZ - S) Differentional Encoding. ~~Encdocon~~

"One" is represented by a no change in level.

"Zero" is represented by a Change in level.

(b) Polar - RZ



"One" & "Zero" are represented by

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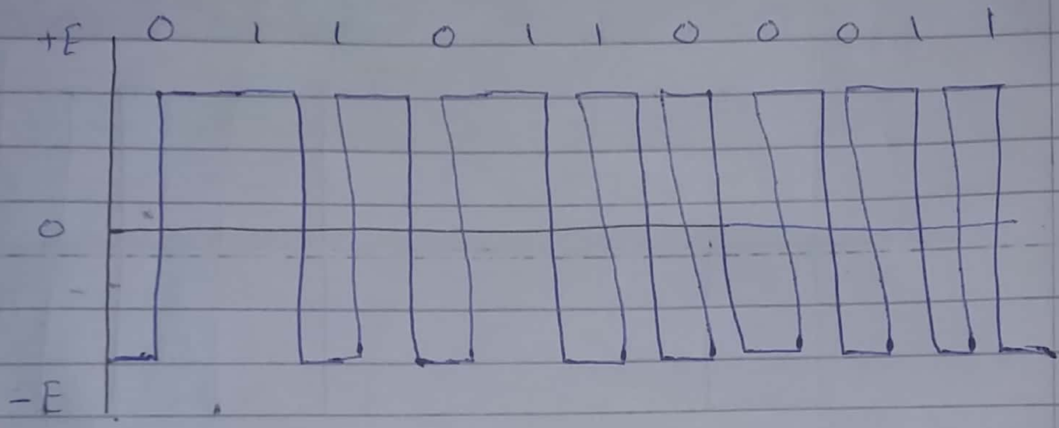
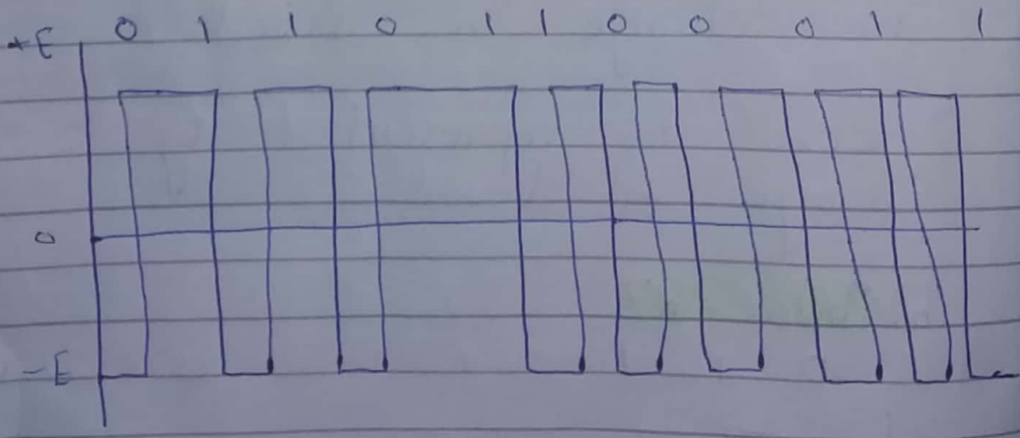
opposite level polar pulses that are one half-bit in width.

(c) Split phase manchester.



"One" is represented by a 10
"Zero" is represented by a 01.

(d) Bi - Φ - L PCM waveform.



Bi - Φ-L (Biphase Level or split phase manchester) 11+180°)
"one" is represented by a 10.
"Zero" is represented by a 01

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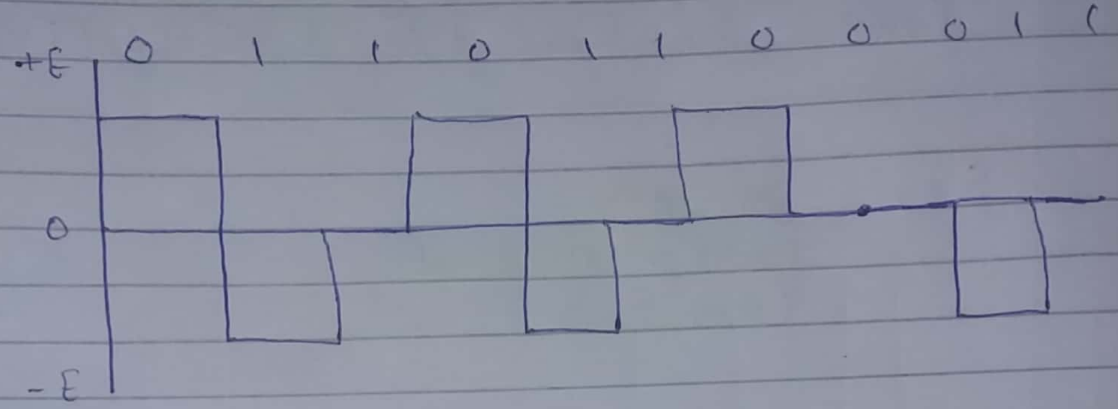
(e) Dicode-NRZ PCM waveform



Dicode Non-Return-to-Zero

A "one" to "Zero" or "Zero" to "one" changes polarity.

otherwise a "Zero" is Sent.

Q:4 (c)

Ans: Given $e_c = 7.5 \sin 20 \times 10^3$

Solution: $e_c = 7.5 \sin 20 \times 10^3$

$E_c = 7.5$ volts

Let us evaluate E_m from E_c since.

$$m = \frac{E_m}{E_c}$$

Therefore

$E_m = m \times E_c = 0.5 \times 7.5 = 3.75$ volt

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$E_{max} = E_c + E_m = 7.5 + 3.75 = 11.25$ volt

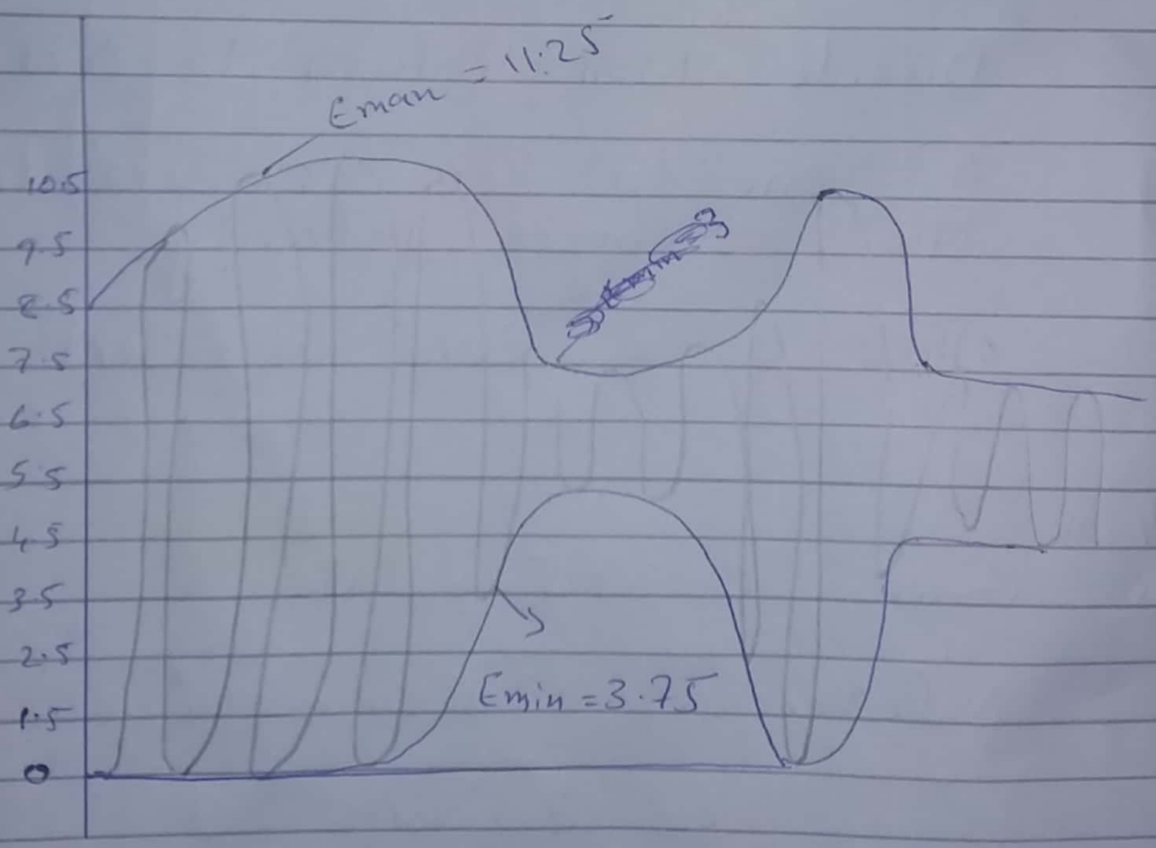
$E_{min} = E_c - E_m = 7.5 - 3.75 = 3.75$ volt

So,

$m = 0.5$

$E_{max} = 11.25$ volt

$E_{min} = 3.75$ volt



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Q.4 (b)

Ans: (a) Depth of modulation:-

$$m = \frac{E_m}{E_c}$$

$$m = \frac{16V}{8V}$$

$m = 2V$

transmission efficiency

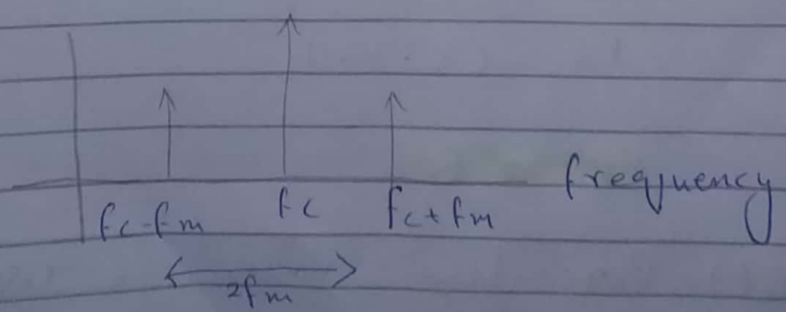
$$tf = \frac{m^2}{2+m^2}$$

$$tf = \frac{(2)^2}{2+(2)^2}$$

$$tf = \frac{4}{2+4} = \frac{4}{6}$$

$tf = 2/3$

(b)



Amplitude frequency

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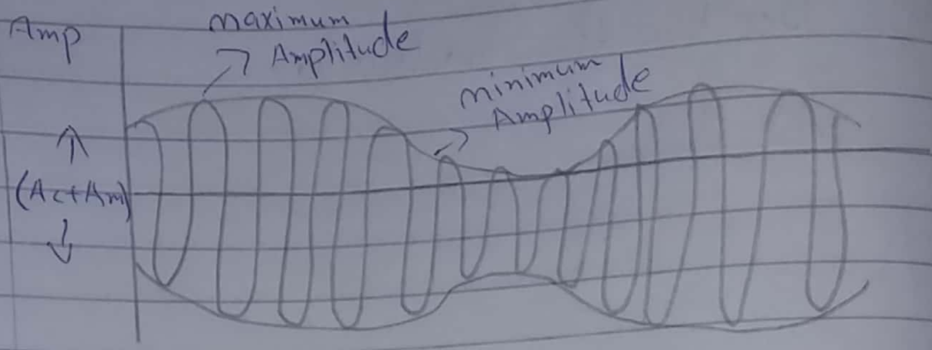

(c) Power in Spectrum:-

$$P_c = \frac{E_c^2}{2 \times R} = \frac{(5)^2}{2 \times 50}$$

$$P_c = \frac{25}{100} = 1/4$$

$$\text{Total Power} = P_t = \left(1 + \frac{m^2}{2}\right) P_c$$

$$P_t = \left(1 + \frac{(2)^2}{2}\right) \times 0.2$$

$$P_t = \left(1 + \frac{4}{2}\right) \times 0.2$$

$$P_t = (1 + 2) \times 0.2$$

$$P_t = (3) \times 0.2$$

$$P_t = 0.6$$

(d) Percentage Power in USB.

$$P_{usb} = \frac{m^2 E_c^2}{8} = \frac{m^2}{4} P_c$$

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$$= \frac{(2)^2}{4} \times 0.6$$

$$= \frac{4}{4} \times 0.6$$

$$P_{usb} = 0.6$$