ANSWER NO 1 (a)

Determine Nyquist rate required for perfect reconstruction of signal.

As we know that for perfect reconstruction of signal.

$\omega s = 2\omega m$

$fs = 2fm$

$\frac{1}{fs} = \frac{1}{2fm}$

$Ts = 2Tm$

$\omega s = 2\omega m$

$2\pi fs = 2 \cdot 2\pi fm$

$fs = 2fm$ putting values:

$\Rightarrow 2 \times 250$

$\Rightarrow 500Hz$ Ans.

(?)

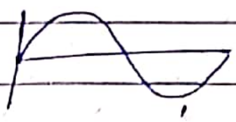
ANSWER #01 (B)

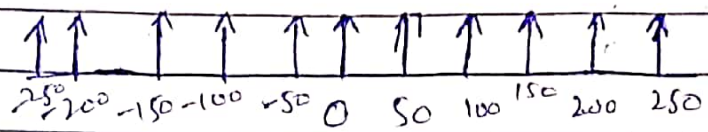
Impulse is a function which is represented as x(t)

As we know that

A signal x(t) band limited by 250Hz.

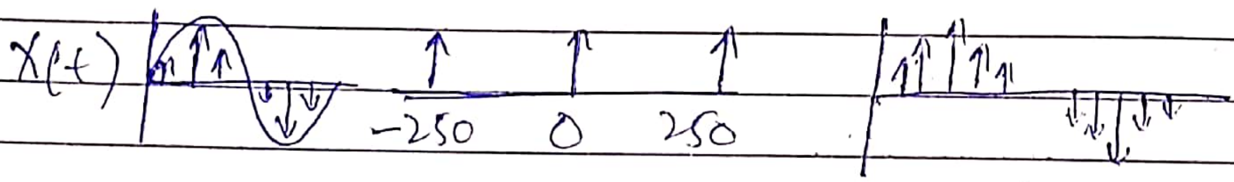
Impulse train:-

x(t) = 



Constant time repeat.

when we pass both signals to spectrum we see



ANSWER # 01 (c)

cutt off frequency.

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

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

$$\Rightarrow \boxed{0.00314}$$

ANSWER #01 (d)

Frequency Sampler $f_s = 800Hz$ draw $S(f)$

Solution:-

$F_m = 250Hz.$

$F_s = 800Hz.$

As we know that

$F_s = 2F_m$

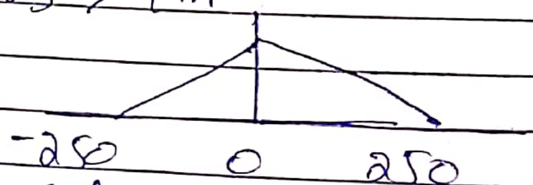
So

$800 = 2(250).$

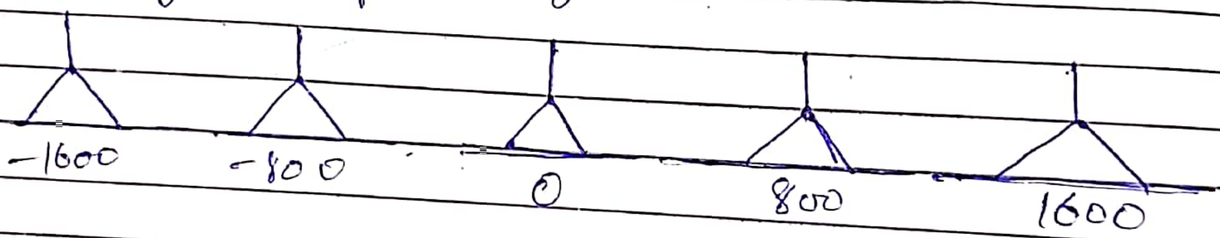
$800 = 500$

So

$F_s > F_m.$



Resulting sampled signal is



ANSWER #02 (A)

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

Solution:-

Nyquist rate $= 2 \times$ maximum signal frequency
Sampling rate unit exceed nyquist rate in order to be able to fully reconstruct signal.

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

Fourier transform $\longrightarrow y(jw) = jw\, X(jw)$
Since max frequency for $y(jw)$ as $X(jw)$ than $y(t)$ nyquist.

(ii) $y(t) = x^2(t)$

As we know
Fourier transform $y(jw) = jw \cdot X(jw)$
Since max frequency for $y(jw)$ is same as $X(jw)$ than $y(t)$ nyquist rate is also w_0

(b)

ANSWER # 02 (b)

Data:-

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

$f_s = 300$ Hz.

cutt off frequency = 150 Hz = f_c

Frequency present in the resconstruct signal is carried.

$y(t)$ is reconstructed signal.

Solution:-

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

so $\omega_m = 400\pi$ rad/sec.

$$f_m = \frac{\omega_m}{2\pi} = \frac{400\pi}{2\pi} = 200 \text{ Hz}.$$

Frequency component of $y(t)$ calculation by frequency formula.

$f_s + f_m$

putting different values of "n".

$n = 0$

$\Rightarrow f_s \pm f_m = 0 \pm f_m = \pm f_m \pm 200$ Hz.

$n = 1$

$\Rightarrow f_s + f_m = 1f_s \pm f_m =$
- $\rightarrow 1f_s + f_m = 300 + 200 = 500$ Hz
- $\rightarrow 1f_s - f_m = 300 - 200 = 100$ Hz.

$n = -1$

$f_s + f_m = $
- $\rightarrow f_s + f_m = -300 + 200 = 100$ Hz
- $\rightarrow f_s - f_m = -300 - 200 = 500$ Hz.

The cutt off frequency is 150 so the frequency range is from -150 Hz to +150 will pass into output.

So
The frequency 100 Hz & -100 Hz is an range
So 100 Hz will be component of output.

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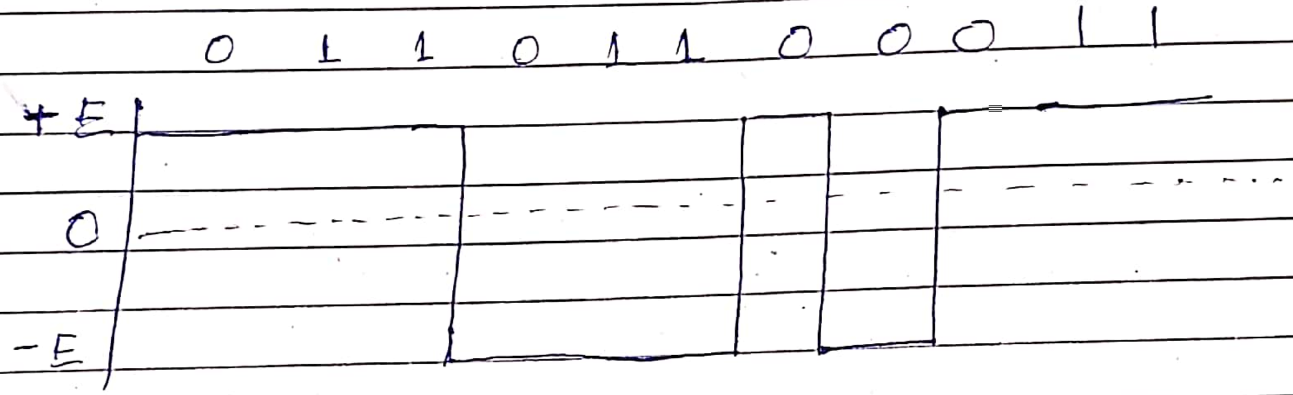
ANSWER #03

(0 1 1 0 1 1 0 0 0 1 1) Bit Sequence.

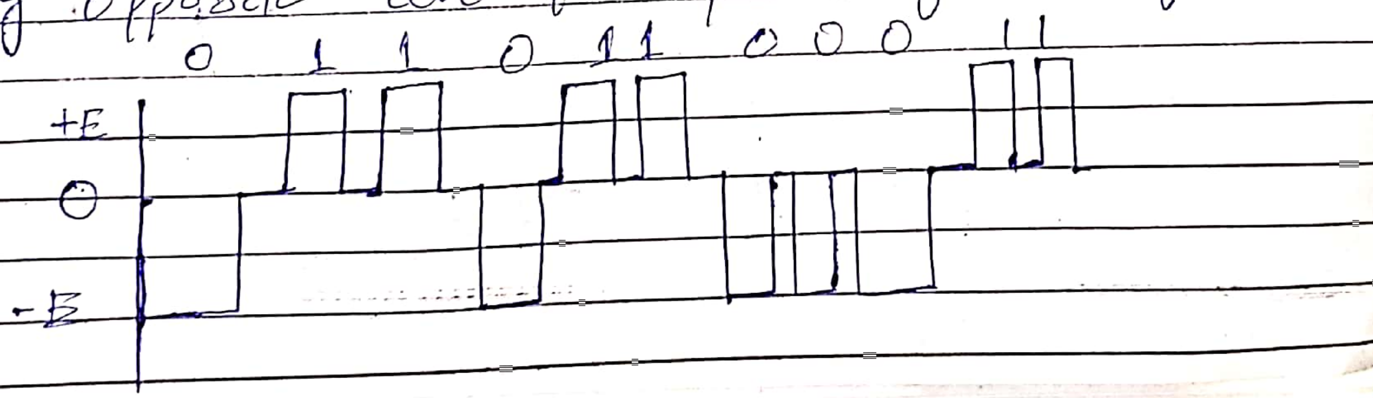
(a) NRZ-S:-

(0 1 1 0 11 0 0 0 11)

↳ "1" is represented by no change in Level.
↳ "0" is represented by a change in Level.



(b) Polar-RZ:- "1" and "0" are represented by opposite Level polar pulse of one half-bit width



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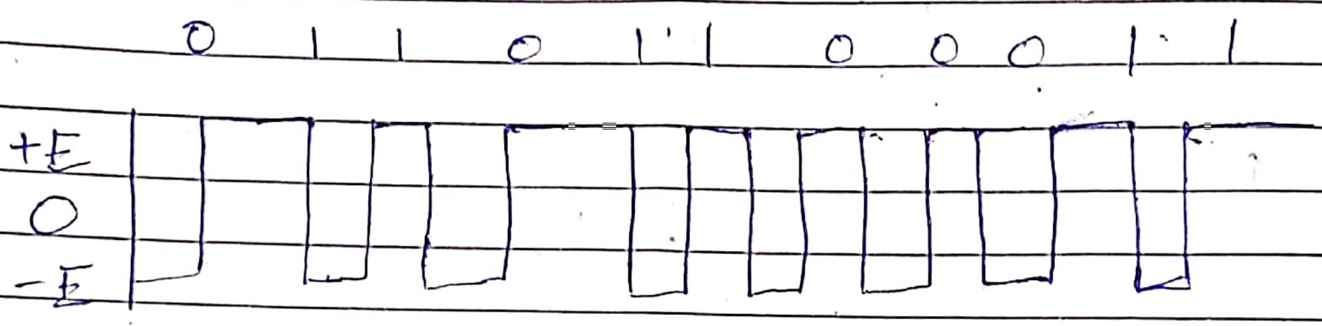
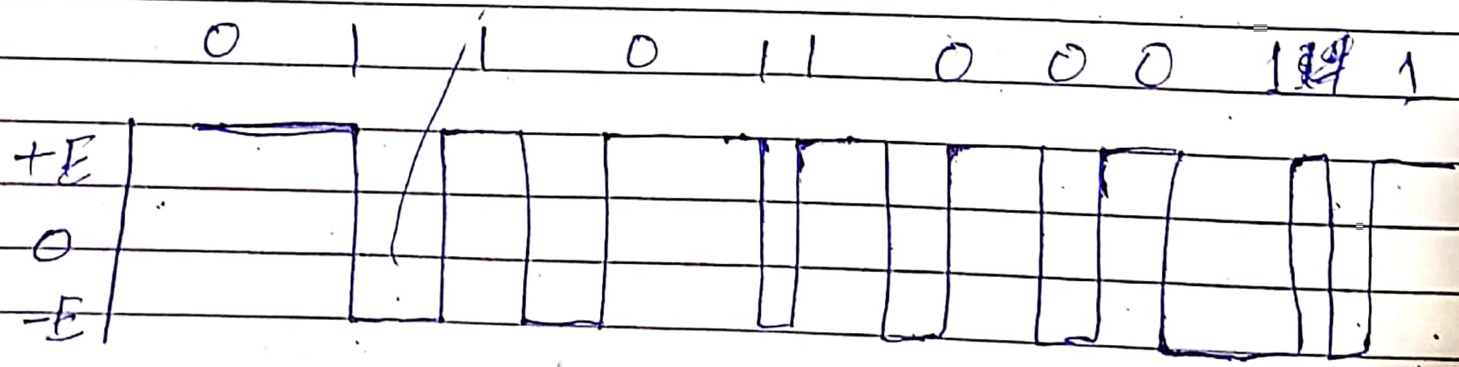
(c) Split phase Manchester:- (11 + 180°)

"1" is represented by a 10
"0" is represented by a 01.



(d) Bi-φ-L:-

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



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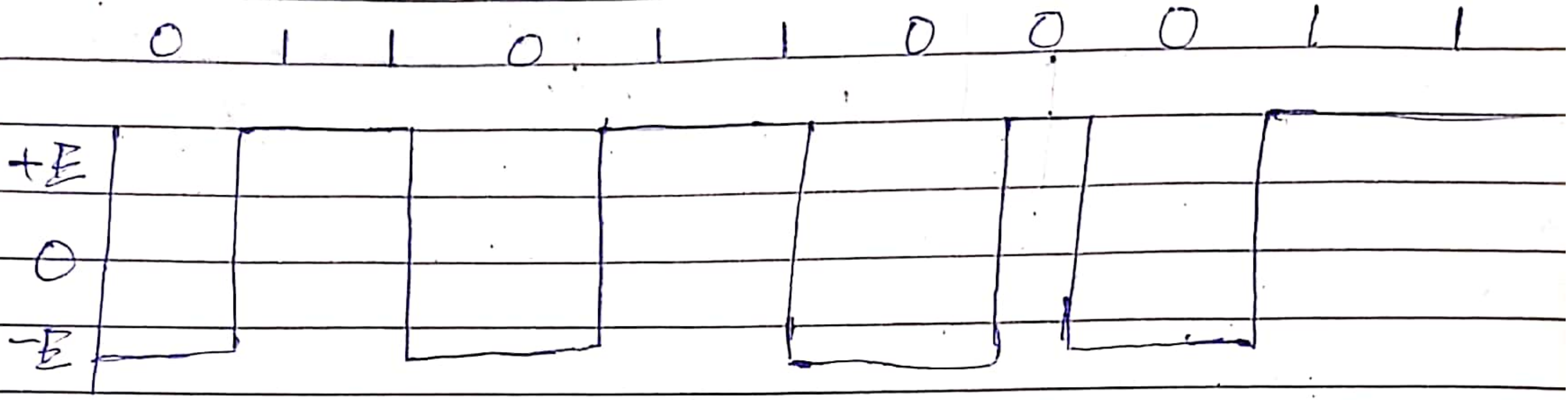
(e) Dicode-NRZ:-

↳ A "one" to "zero" or "zero" to "one" changes polarity.

↳ otherwise, a "zero" is sent.



ANSWER #04 (a)

Sol:- $m = 0.5$ $C_c = 7.5$, $E_c = 7.5V$

Let us consider E_m from E_c

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

So

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

$$E_{max} = E_c + E_m$$
$$= 7.5 + 3.75$$
$$= 11.250V$$

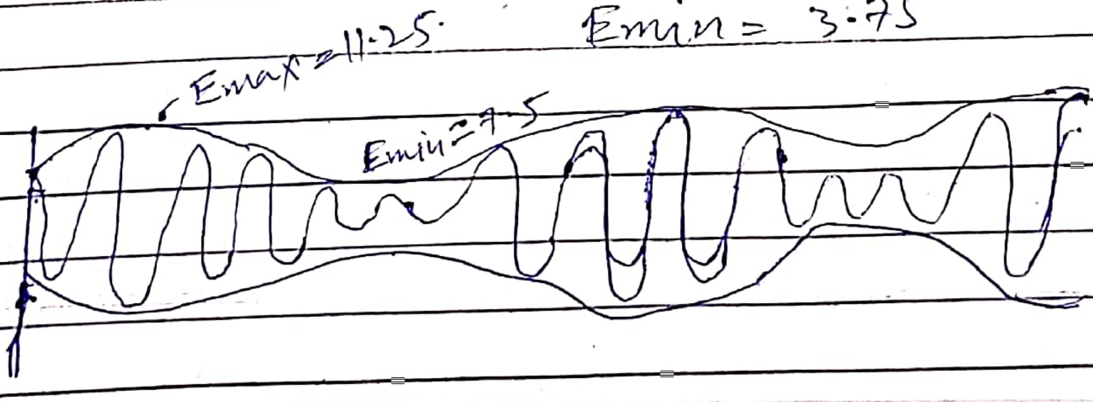
$$E_{min} = E_c - E_m$$
$$= 7.5 - 3.75$$
$$= 3.75V.$$

Modulated wave form.

As we know $n = 0.5$

$E_{max} = 11.25$

$E_{min} = 3.75$



ANSWER #04 (b)

(a) Depth of modulation:-

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

$$m = \frac{10V}{5V} = 2V.$$

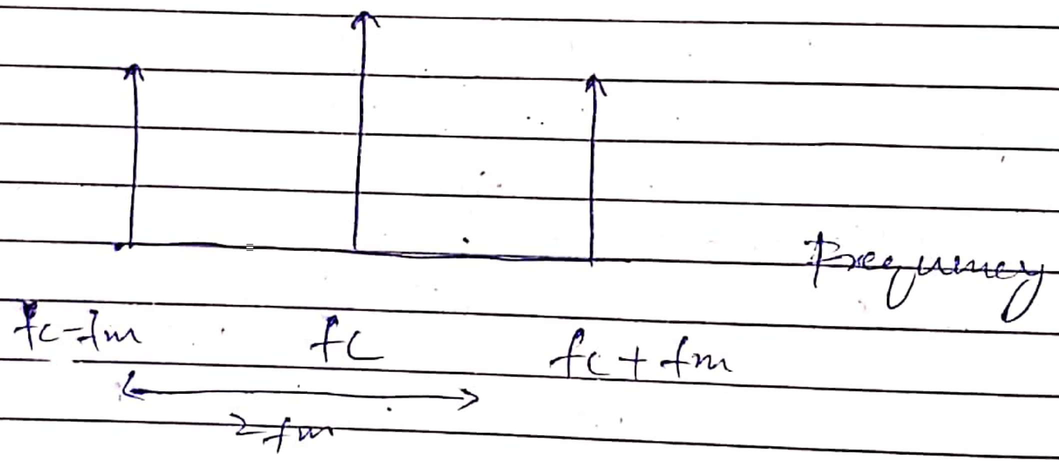
Transmission efficiency:-

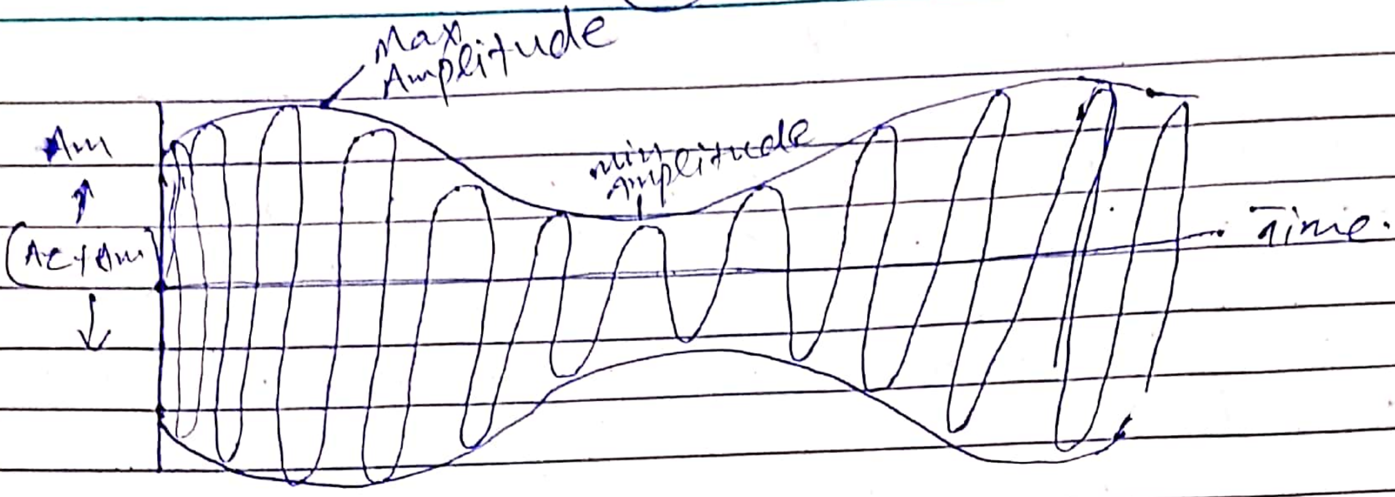
$$tf = \frac{m^2}{2+m^2}$$

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

$$t(f) = \frac{4}{2+4} = 4/6 = 2/3$$

(b) Amplitude frequency.





(c) Power in Spectrum

$$P_c = \frac{E_c^2}{2R} = \frac{(5)^2}{2 \times 50} = \frac{25}{100} = \frac{1}{4} = 1/4$$

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

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

$$P_t = \left(1 + 4/2\right) 0.2$$

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

$$P_t = 3 \times 0.2 = 0.6\ V$$

(d) Pecentage in USB

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

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

$$= 4/4 \times 0.6$$

$$= 0.6$$