Name

Hamza

I.D

16469

Subject

C.S

Q1

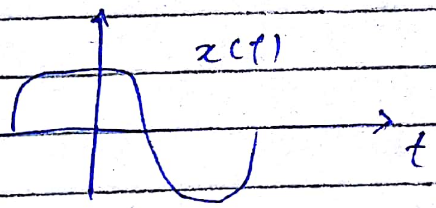
1(a)

Nyquist rate $\geq 2f_h$.

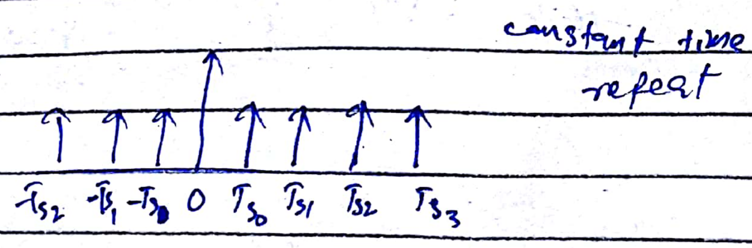
Here in this question, $f_h = 250$ Hz

$\therefore$ Nyquist rate $\geq 2 \times 250 \geq 500$ Hz

(b) There is only one signal which is involved in sampling and is given below:



Implse train



$$c(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_s)$$

(c) The cut off frequency will be 250 Hz.

Q1

(d) $F_m = 250\ Hz$

$F_s = 800\ Hz$

As we know that

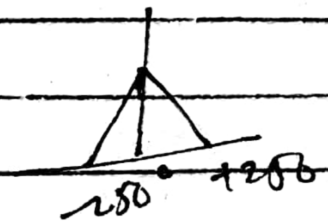
$$F_s = 2F_m$$

So $800 = 2(250)$

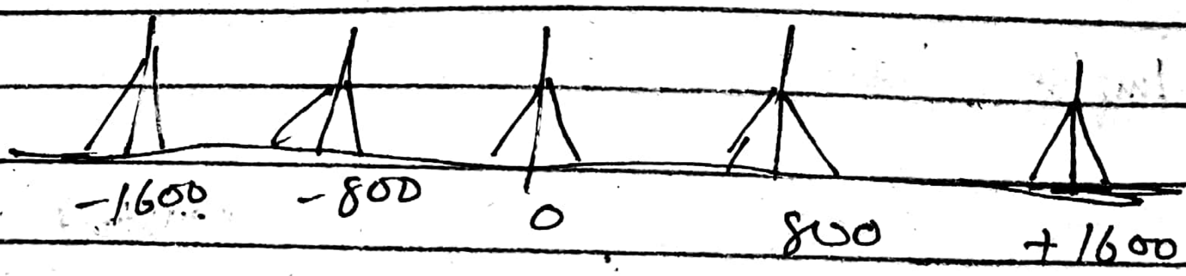
$800 = 500$

So

$$F_s > F_m$$



The resulting sampled signal is:



Q2 (a) ① $x(t) = f_s$

$m(t) = x(t) + x(t-1) \longrightarrow NR = ?$

$\downarrow$ f_s $\qquad$ $\downarrow$ f_s

There will be no change in NR

So the NR is f_s

$NR = f_s$

(ii) $x(t) = f_s$

$m(t) = \frac{dx(t)}{dt}$

we know the differentiation will not change the NR.

So the $NR = f_s$

Q 2
(b)

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

$\omega_m = 400\pi$ rad/sec

$f_m = \frac{\omega_m}{2\pi}$

$= \frac{400\pi}{2\pi}$

$f_m = 200\ Hz$

$f_s = 300\ Hz$

$f_c = 150\ Hz$

ideal

$s(t) \longrightarrow$ LPF $\longrightarrow m_r(t)$

$\Downarrow\Uparrow$

$S(\omega)$

$nf_s \pm f_m$

Put $n = 0$

$0 \pm f_m = \pm 200\ Hz$

which is out of range of cutoff frequency

Put $n=-1$

$-f_s \pm f_m = -100\ Hz, -500\ Hz$

so $-100\ Hz$ in range of cutoff frequency

Put $n=1$

$f_s \pm f_m = 500\ Hz, 100\ Hz$

so $100\ Hz$ in range of cutoff frequency

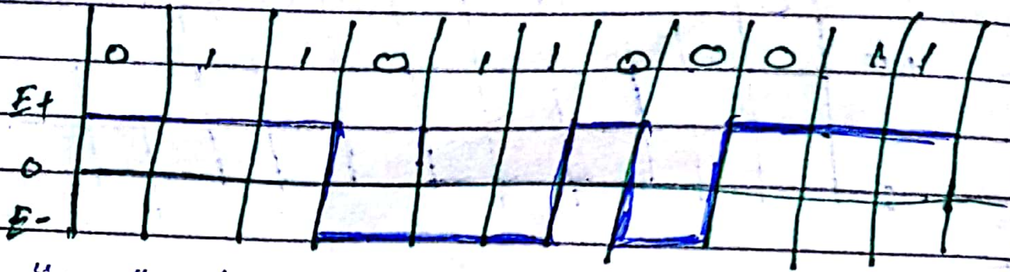
Frequency present in the reconstructed signal are $100\ Hz, -100\ Hz$

The cut off frequency is 150 so the Frequency is Rang from $-150\ Hz$ to $+150\ Hz$ will pass into output.

So frequency 100 Hz and -100 Hz in an rang so 100 Hz will be component of output.

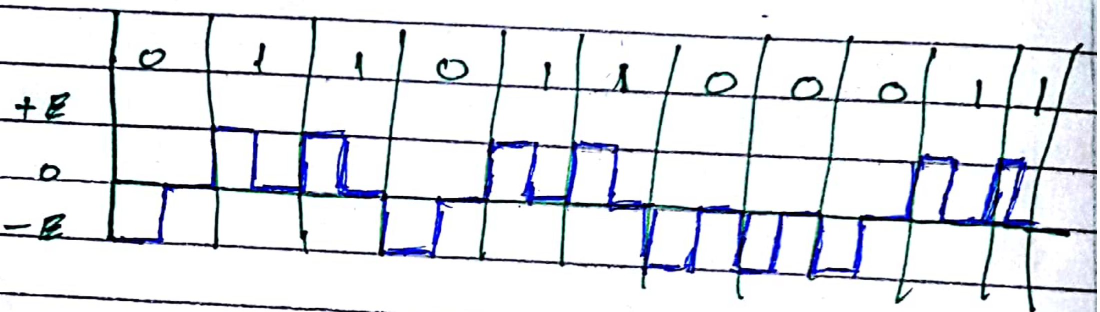
Q3

(a) NRZ-S

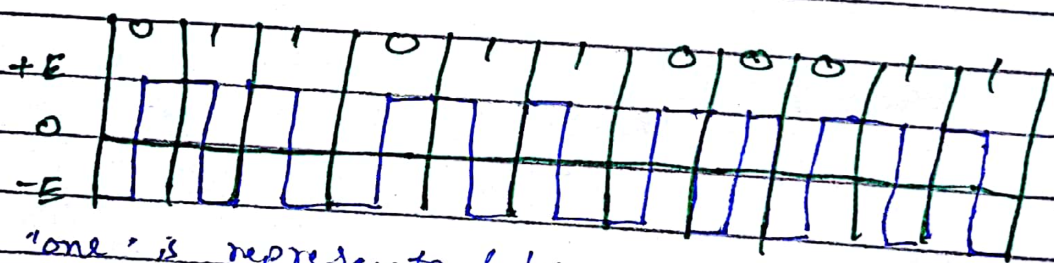


"one" ~~the~~ can not change the wave
"zero" have the change.

(b) Polar - RZ

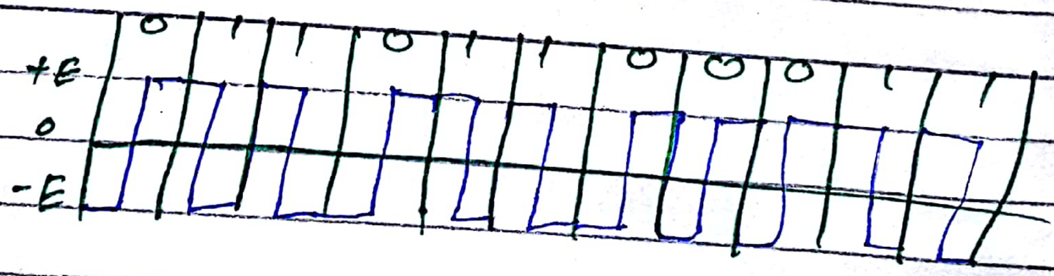


(c) Split phase machoster



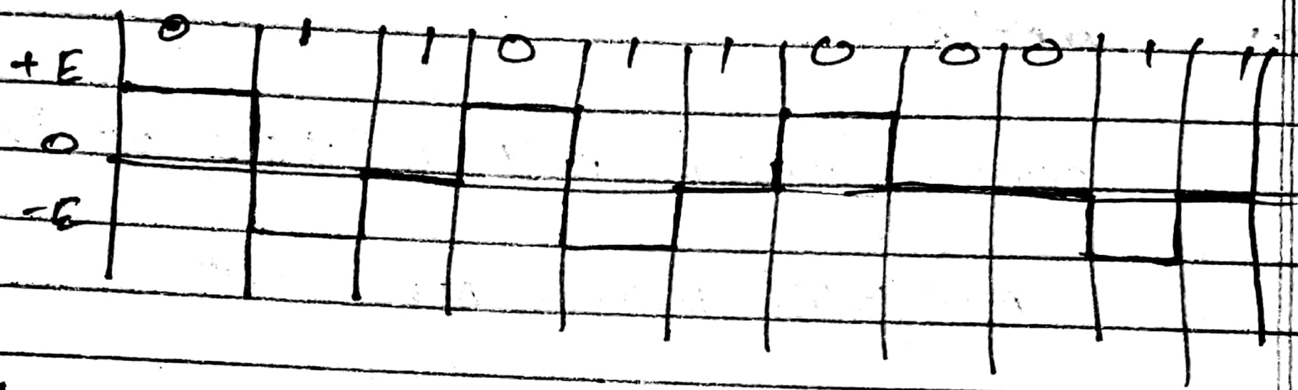
"one" is represented by a 10
"zero" is represented by a 01

(d) Bi-φ-L



"one" is represented by a 10
"zero" is represted by a 01

(e) Dicode - NRZ



"one" to zero & "zero" to "one" change polarity otherwise a zero is sent.

P4 (a)

~~constdes~~

carrier wave is $e_c(t) = 7.5 \sin 20 \times 10^3 \pi t$

Modulation index = MI = 0.5

The General equation of sine wave is

$c = A \sin(\omega t)$

A is Amplitude of the wave

comparing General equation of wave with given then AC will be 7.5

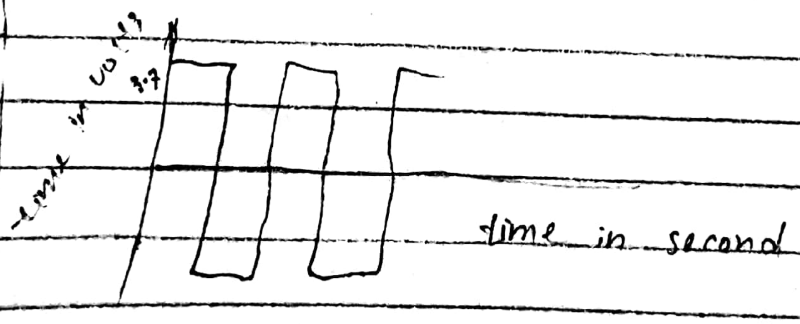
as we know that

$m = MI = \frac{Am}{Ac}$

~~Am = m × A~~

$Am = MI \times Ac = 0.5 \times 7.5$

$Am = 3.75$



Q 4(b) (a) Depth of modulation

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

$$m = \frac{100}{50} = 2V$$

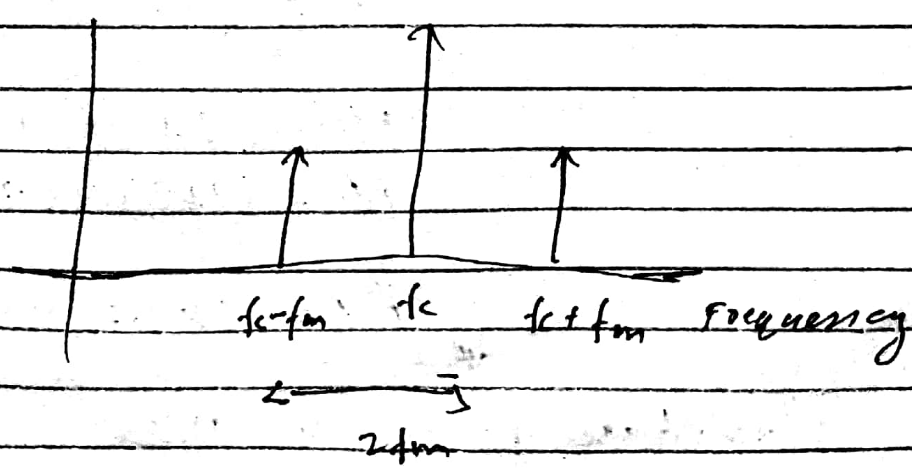
transmission efficiency

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

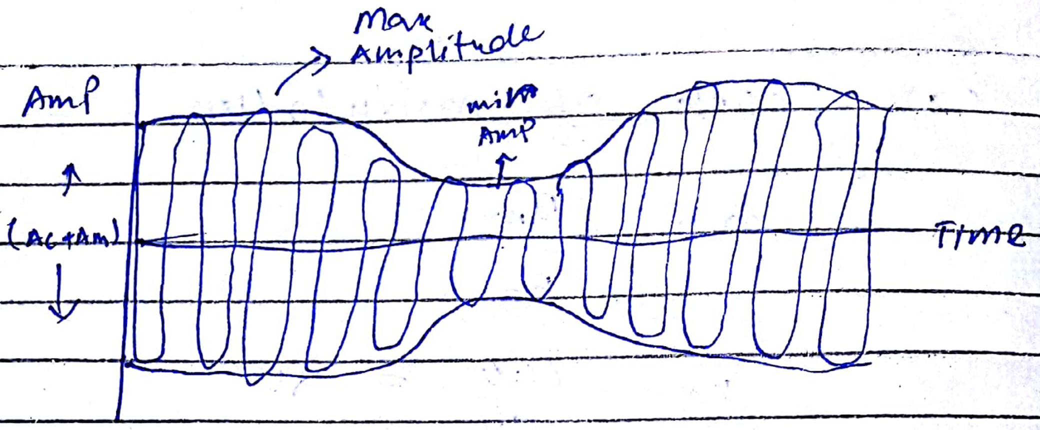
$$= \frac{(2)^2}{2+(2)^2} = \frac{4}{2+4} = \frac{4}{6}$$

$$tf = 2/3$$

(b)



Amplitude frequency



(c)

power in Spectrum:-

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

$$\boxed{P_c = \frac{1}{4}}$$

and total power :- $P_t = \left(1 + \frac{m^2}{2}\right) P_c$

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

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

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

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

(d) Percentage power in USB

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

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