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Name: Hamza Ishaq

Communication System

Question 1

(a)

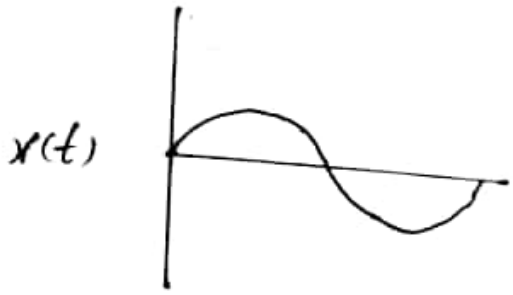
Nyquist rate

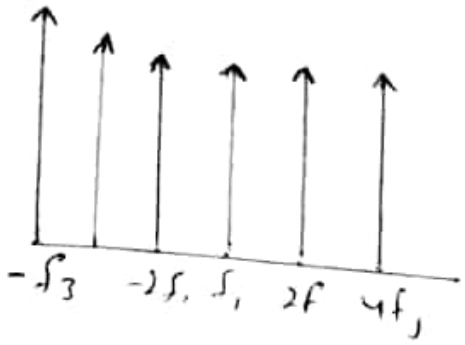
$N_R > 2f_m$

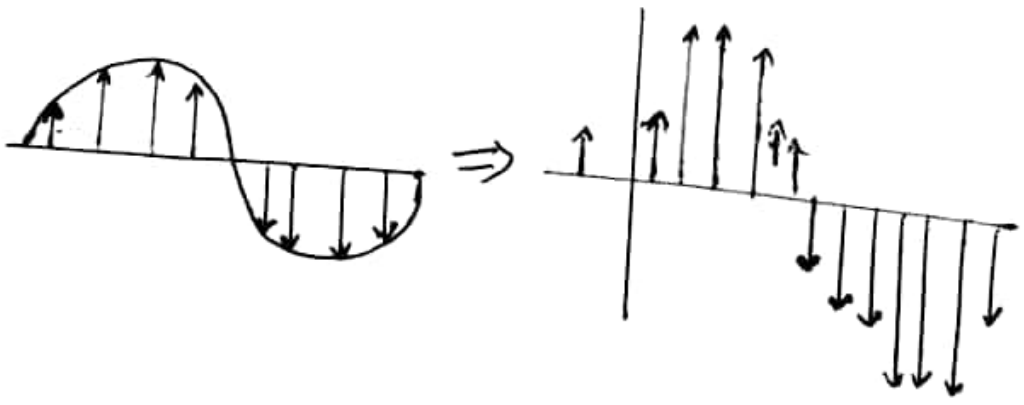
$= 2 \times 250$

$= 500\ Hz$

(b)







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(c)

Cutt of frequency

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

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

(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

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Communication System (3)

Question No 2

Part (a)

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

Sol:

Nyquist rate = 2x maximum signal frequency

→ Sampling rate unit exeed Nyquist rate in order to be able to fully reconstruct the signals.

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

Fourier transform → $y(jw) = jw(jw)$

Since the max frequency for $Y(jw)$ is the same $X(jw)$ then $y(t)$ Nyquist rate is also w_0

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

we can rewrite the above

Fourier transform → $Y(jw) = jw * (jw)$

Since the max frequency for $Y(jw)$ is

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Communication System (4)

the same as X(jω) then y(t) Nyquist rate is also ω.

Part (b)

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

$f_s = 300$ Hz

Cut off frequency = 150 Hz = f_c

The frequency present in that reconstructed signal is carry the reconstructed signal is y(t)

Sol:

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

$50^{\omega_m} = 900\pi$ rad/sec

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

freq component of y(t)

1st we calculate sample frequency by formula $0f_s + f_m$

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Communication Systems (5)

Put different value of n

$n = 0$

$\Rightarrow fs \pm fm = 0 \pm fm = \pm fm = \pm 200\ Hz$

$n = 1$

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

$n = -1$

$\Rightarrow fs + fm =$ $fs + fm = -300 + 200 = 100\ Hz$; $fs - fm = -300 - 200 = 500\ Hz$

The cut of frequency is 150 so the frequency is Range from $-150\ Hz$ to $+150$ will pass into output

So frequency $100\ Hz$ $-100\ Hz$ is on range to $100\ Hz$ will be component of output

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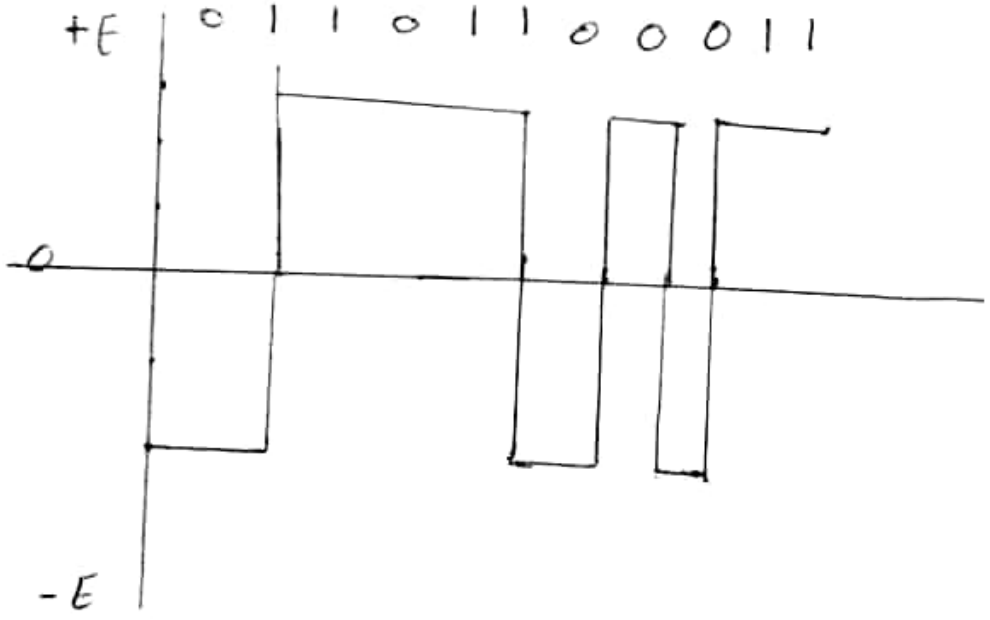
Communication System (6)

Question 3

Ans.

a) NRZ-S PCM waveform

(0 1 1 0 1 1 0 0 0 1 1)



NRZ Space (NRZ-S differential Encoding

"One" is represented by a no change in level

"Zero" is represented by a change in level.

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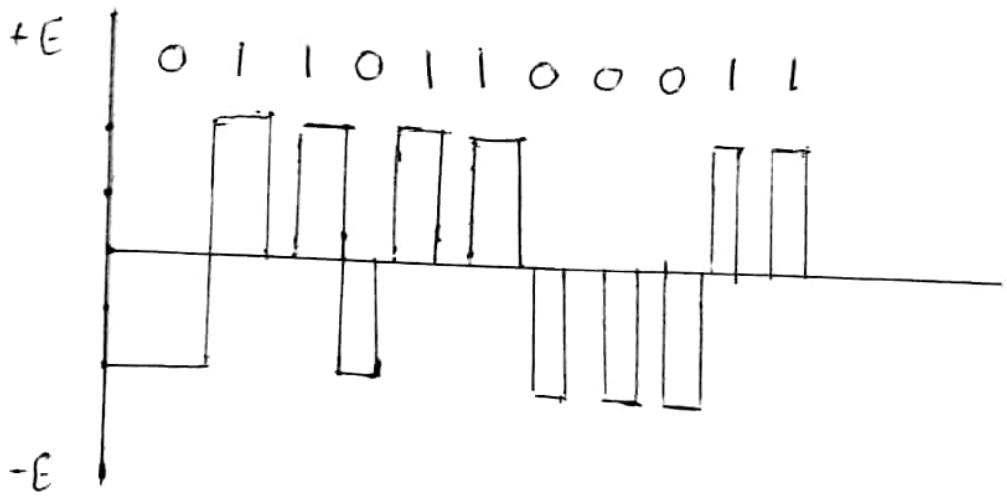
Communication System (7)

b - Polar – Rz



"One" and "zero" are represented by opposite level polar pulses that are one half bit in width.

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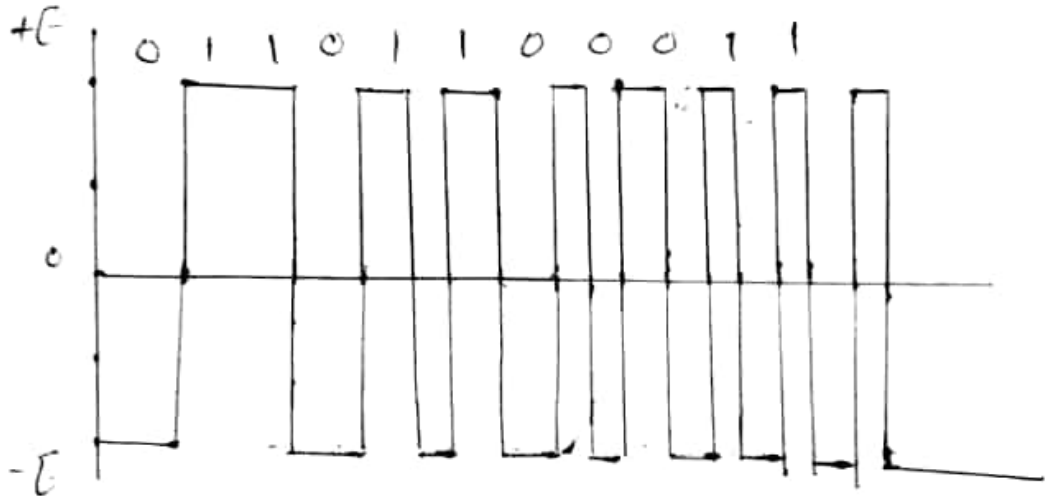
Communication System

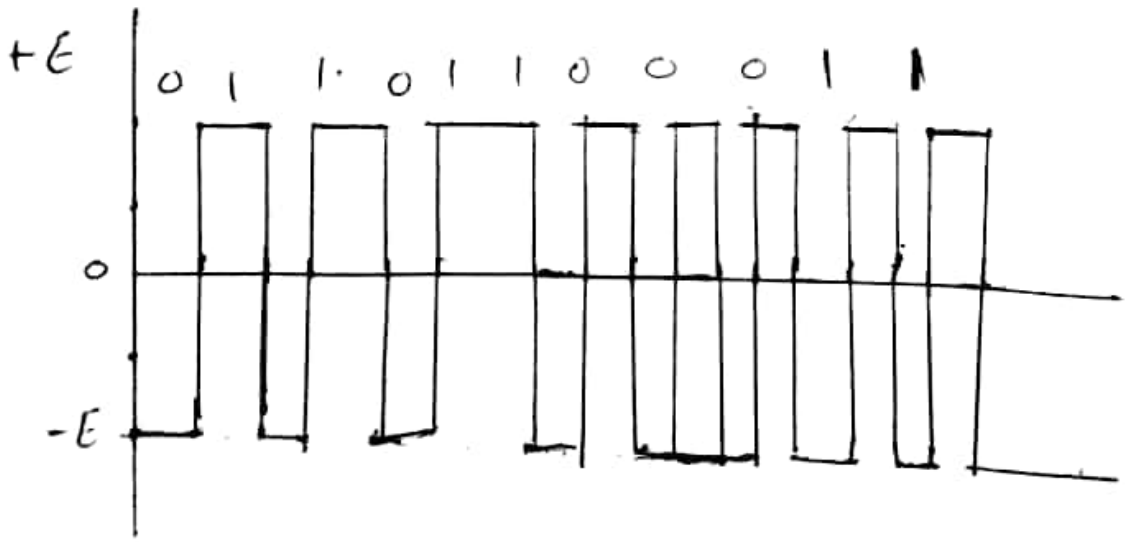
(C) split Phase Manchester:



"one is represented by a 10

"Zero" is represented by a 01.

(d) B-Φ-L PCM waveform



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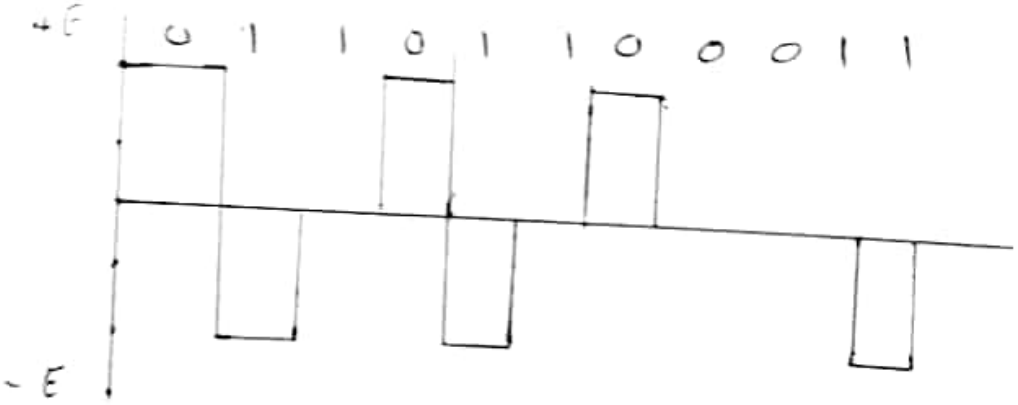
Communication System

B-ϕ-L (Biphase level or split phase manchester) (1+18)

"One" is represented by a 10

"Zero" is represented by a 01

(e) Dicode-NRZ PCM wave



Dicode Non-Return-to-zero

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

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Communication System (10)

Question 4

Part (a)

Solution:

$m = 0.5 \quad = 7.5 \quad E_c = 7.5$ volts

let us consider Emform E_c since.

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

Therefore

$$E_m = m \times E_c$$
$$= 0.5 \times 7.5$$
$$= 3.75 \text{ volt}$$

$$E_{max} = E_c + E_m$$
$$= 7.5 + 3.75$$
$$= 11.2500 \text{ Hz}$$

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

modulated wave form

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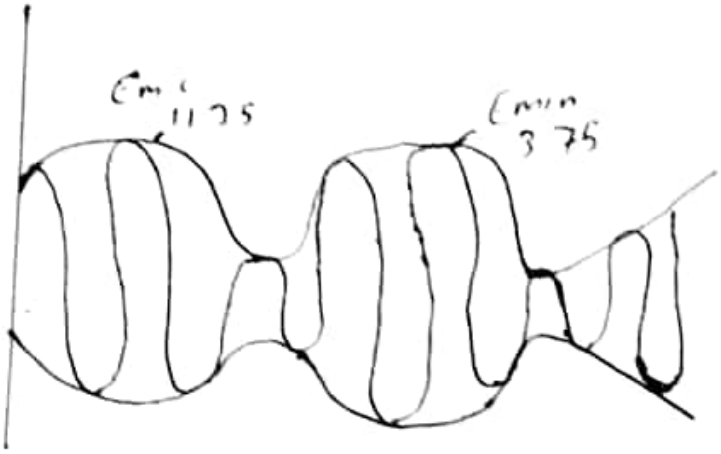
Communication System (11)

So As we know that

$n = 0.5$

$E_{max} = 11.25$

$E_{min} = 3.75$



Parb (b)

Depth of modulation

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

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

Transmission Efficency

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

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

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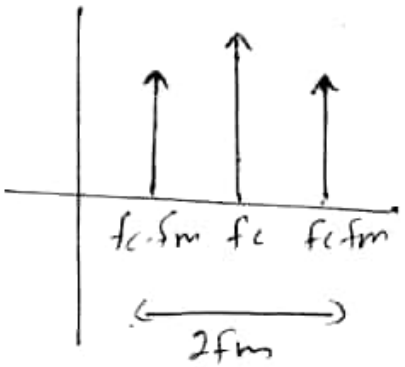
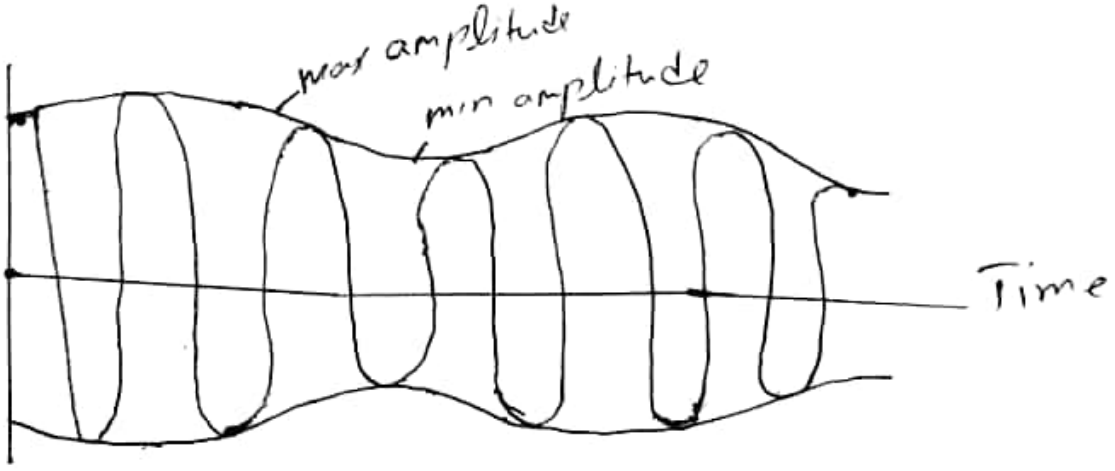
Communication System

(12)

$$tf = \frac{4}{2+4} = \frac{4}{6} = \frac{2}{3}$$



Amplitude frequency



Part (C)

Power in Spectrum

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