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20-42277-1   sec-F

①

① Given

   bandwidth = 200 KHz

   level = 1024

(i)

Bit Rate   BR $= 2 \times BW \times \log_2 L$

$= 2 \times 200 \times 10^3 \times \log_2 1024$

$= 4000000$ bps

$= 4$ Mbps

(ii) $n_b = \log_2 1024$

$= 10$

SNRdB $= 6.02 \times 10 + 1.76$

$= 61 \times 7$

$= 61.76$ dB

(iii) B min $= n_b \times$ Bandwidth

$= 10 \times 200 \times 10^3$ Hz

$= 2$ MHz

Polar NRZ -I

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        0    1    0    0    1   -1
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NRZ-I ⟶ time

monchester ⟶ time

Diff morchester ⟶ time

AmI ⟶ time

③ We know

$$S = C \times N \times \frac{1}{r}$$
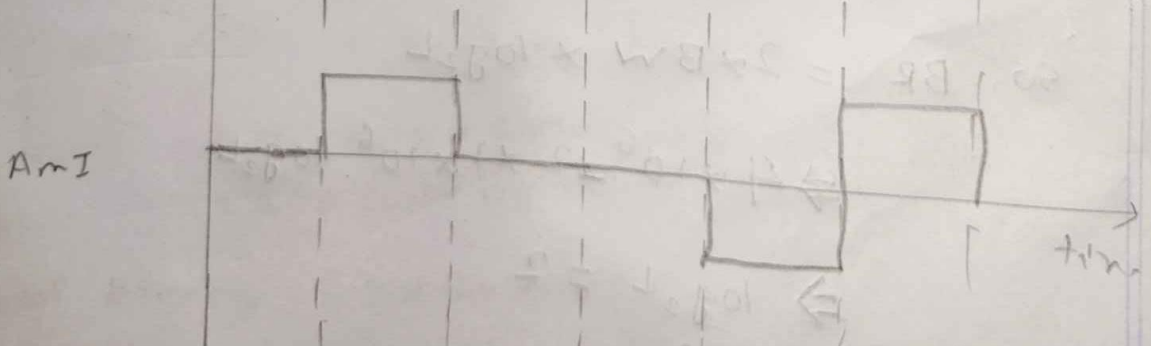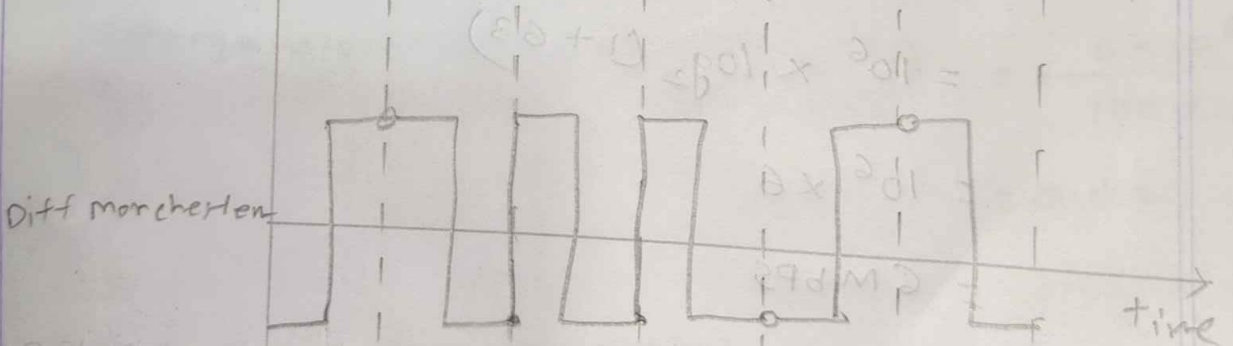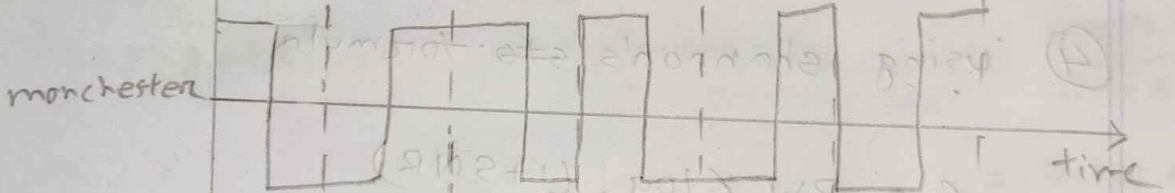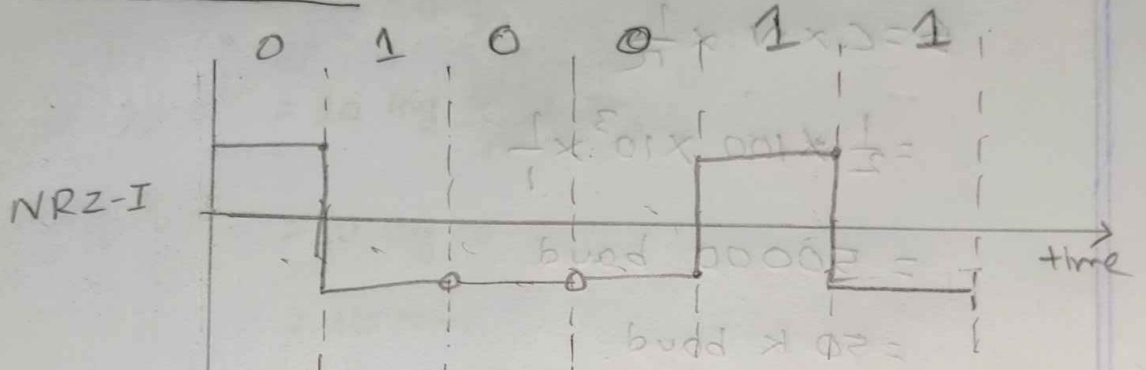
$$= \frac{1}{2} \times 100 \times 10^3 \times \frac{1}{1}$$

$$= 50000 \text{ baud}$$

$$= 50 \text{ k baud.}$$

④ using shannon's s̶t̶o̶·̶ formula

$$C = BW \times \log_2 (1 + SNR)$$

$$= 10^6 \times \log_2 (1 + 63)$$

$$= 10^6 \times 6$$

$$= 6 \text{ MbPS}$$

for better performance we choose 4 MbPS

so, BR $= 2 \times BW \times \log_2 L$

$$\Rightarrow 4 \times 10^6 \cancel{=} 2 \times 1 \times 10^6 \log_2 L$$

$$\Rightarrow \log_2 L = 2$$

$$\Rightarrow L = 2^2$$

$$= 4 \text{ levels}$$

(5) We know

$$dB = 10 \log \frac{P_2}{P_1}$$

$$= 10 \log \frac{10 P_2}{P_1}$$

$$= 10 \log 10$$

$$= 10 \ mw$$

(6) latency =

Propagation time $\Rightarrow \dfrac{Distance}{Propagation\,speed} = \dfrac{2000\,Km}{2.8 \times 10^8}$

$$= 7.14 \ \mu s$$

transmission time $= \dfrac{message\ size}{bandwidth} = \dfrac{6 \times 10^6}{100 \times 10^6}$

$$= 0.063$$

$$= 60000 \ \mu s$$

latency = Propagation time + transmission time
+ queuing time + Processing delay

$$= 7.14 \ \mu s + 60000 \mu s + 7 \mu s + 8 \mu s$$

$$= 60022.14 \ \mu s$$

total latency $= 9 \times 60000 NS \ NS$

$$= 540122.26 = 0.545$$