Part B

Department: CSE

Program: BSc in CSE

Course no: CSE3211

Course Title: Data communication

Examination: Final

Semester (session): Fall 2019

Student no: 170104077

Signature and Date: Rajiv
15/10/2020

ID: 170104077

Course no: CSE 3211

Raju

Ans to the Ques no 1(a)

Given,

bandwidth of the low pass signal, $B = 560$ KHz

$\therefore$ frequency $f_{max} = 560$ KHz

Levels of quantization, $L = 2048$

$\therefore$ number of bit per sample $n_b = \log_2 L$

$= \log_2 (2048)$

$= 11$

i) Sampling rate, $f_s = f_{max} \times 2$

$= 560 \text{ KHz} \times 2$

$= 1120$ KHz

$\therefore$ bit rate of the digitized signal $N = f_s \times n_b$

$= 1120 \times 11$ kbps

$= 12320$ kbps

$= 12.32$ Mbps

ID: 170104077 Rajin

Course no: CSE3211

ii) We know,

PCM Bandwidth, $B = C \times N \times \frac{1}{n}$

$= \frac{1}{2} \times 12320 \text{ Kbps} \times \frac{1}{n}$

$= \frac{6160}{n} \text{ KHz}$

for NRZ or bipolar signal $n = 1$, then the bandwidth will be 6160 KHz

ID: 170104077

Course no: CSE 3211

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Ans: to the Ques no 1(b)

Given,

$V_{max} = 120V$

$V_{min} = -120V$

$\Delta = 15$

$$\therefore \Delta = \frac{V_{max} - V_{min}}{L}$$

$$\Rightarrow L = \frac{120 + 120}{15}$$

$$= 16$$

$\therefore$ The given range can be divided into 16 zones.

ID: 170104077

Course no: CSE3211

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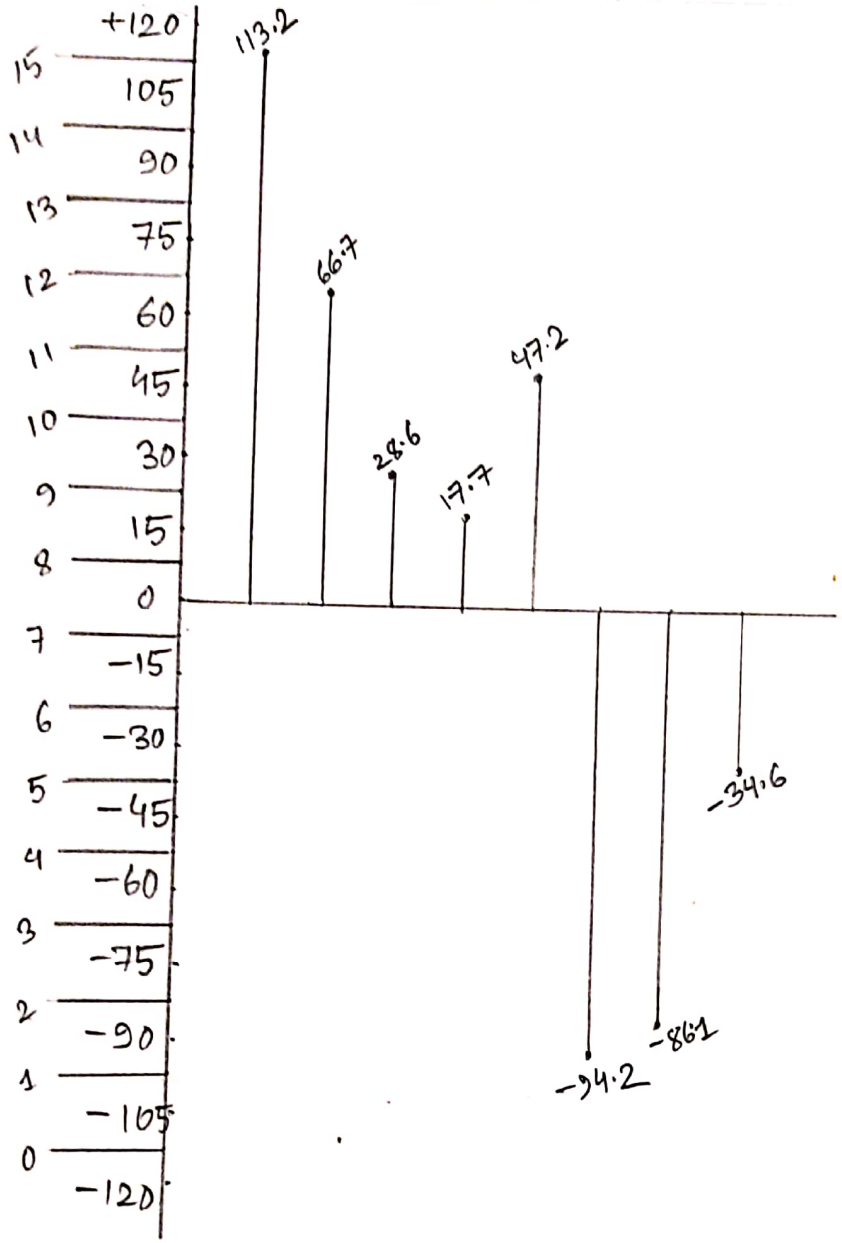

Actual Amplitude	113.2	66.7	28.6	17.7	47.2	-94.2	-86.1	-34.6
Normalized PAM values	7.5	4.45	1.91	1.18	3.15	-6.28	-5.75	-2.31
Quantization values	112.5	67.5	22.5	22.5	52.5	-97.5	-82.5	-37.5
Normalized Quantized values	7.5	4.5	1.5	1.5	3.5	-6.5	-5.5	-2.5
Normalized Error	-0.05	0.05	-0.41	0.3	0.35	-0.22	0.25	-0.19

ID: 170104077
Course no: CSE 3211

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Ans: to the Ques no 2(a)

from figure 1,

Quantization code: 15 12 9 9 11 1 2 5

Encoded word : 1111 1100 1001 1001 1011 0001 0010 0101

Ans: to the Ques no 2(b)

Applying 4B/5B to the result of 2(a), we get

11101 11010 10011 10011 10111 01001 10100 01011

Ans: to the Ques no 2(c)

Applying 8B/6T to the ~~Ans~~ result of 2(b), we get

11101 11010	10011 10011	10111 01001	10100 01011
EE	A7	3B	A5	8B

and it will be encoded as following signal pattern,

EE → ++−0+−

A7 → ++−00−

3B → 0+−−0+

A6 → ++−0−0

8B → 0−000+

ID: 170104077

Course no: CSE3211

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