Q We have sampled a low pass signal with a bandwidth of 200 KHz using 1024 levels of quantization
(a) calculate the bit rate of the digitized signal
(b) Calculate the SNR_{dB} for this signal.
(c) calculate the PCM bandwidth of this signal.

(a) In a low pass signal, the minimum frequency is 0 therefore we can say

$$f_{max} = 0 + 200 = 200\ KHz$$

$$f_s = 2 \times 200{,}000 = 400{,}000\ sample/sec$$

The number of bits per sample and bit rate are

$$n_b = \log_2 1024$$

$$= 10\ bits/sample$$

$$N = 400\ KHz \times 10 = 4\ Mbps$$

(b) The value of $n_b = 10$
We can calculate the value of SNR_{dB}

$$SNR_{dB} = 6.02 \times n_b + 1.76$$

$$= 61.96$$

(c) The value of $n_b = 10$
The minimum bandwidth can be calculated as

$$B_{pcm} = n_b \times Bandlog$$

$$= 10 \times 200\ KHz$$

$$= 2\ MHz.$$

Q

A TV channel has a bandwidth of 6MHz. if we send a digital signal using one channel, what are the data rates if we use

- ONE harmonics
- THREE haronics
- Five harmonics.

Ans

① BW from 0 to f 1st harmonic = 6 MHz

Bit rate = 2x f 1st harmonic

= 2x6

= 12 Mbps

②

BW from 0 Hz to f 3rd harmonic = 6 MHz

f 3rd harmonic = 3x f 1st harmonic

= 6Mbps / 3

= 2 MHz

Bit rate = 2x 1st harmonic

= 2x2 = 4 Mbps

③

BW from 0 Hz to f 5th harmonic = 6 MHz

f 1st harmonic = 6 MHz / 5

= 1.2 MHz

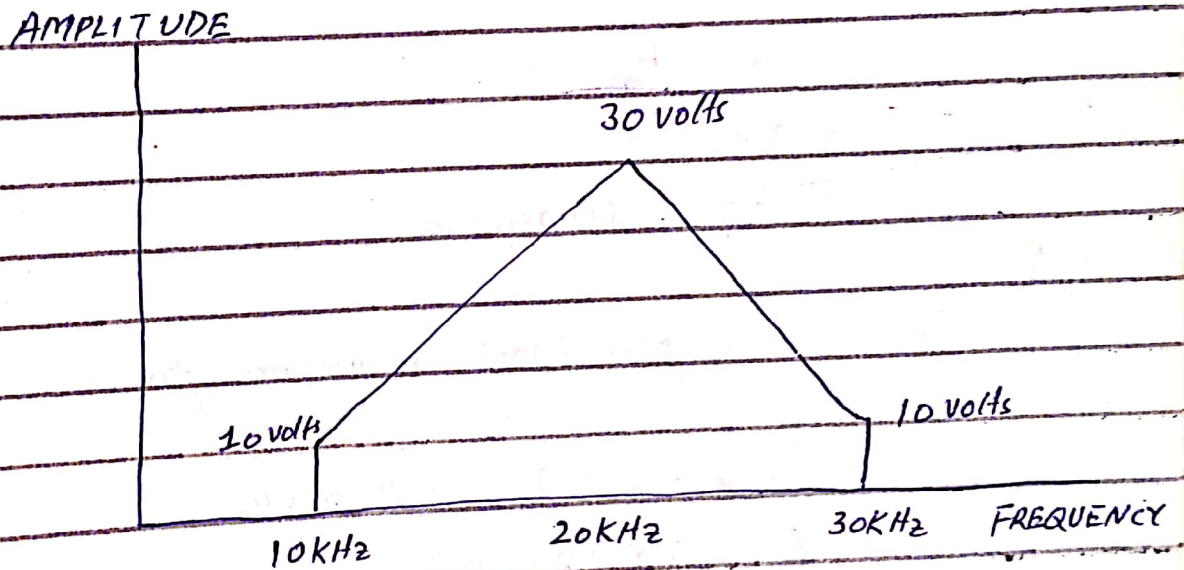
Bit rate = 2x f 1st harmonic

= 2x1.2

= 2.4 Mbps

Q A non periodic composite signal contains frequencies from 10 to 30 KHz. The peak amplitude is 10 volts for the lowest and the highest signal and is 30 V for the 20 KHz signal. Assuming that the amplitude change gradually from the minimum to the maximum. draw the frequency spectrum.

ANS



What is the Nyquist sampling rate of each of the following signals.

(a) A low pass signal with bandwidth of 200 KHz?

(b) A band pass signal with bandwidth of 200 KHz if the lowest frequency is 100 KHz.

Ans

(a) $F_s = 2 \times F_m$

$= 2 \times 200$

$= 400$ K samples/sec

OR

In a low pass signal, minimum frequency is 0

So

$f_{max} = 0 + 200 = 200$ KHz

$f_s = 2 \times 200,000$

$= 400,000$ samples/sec.

(b) For band pass signal

$f_{max} = 100 + 200 = 300$ KHz

$f_s = 2 \times 300,000$

$= 600,000$ samples/s.