CSE 320

Assignment 02

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section : 18

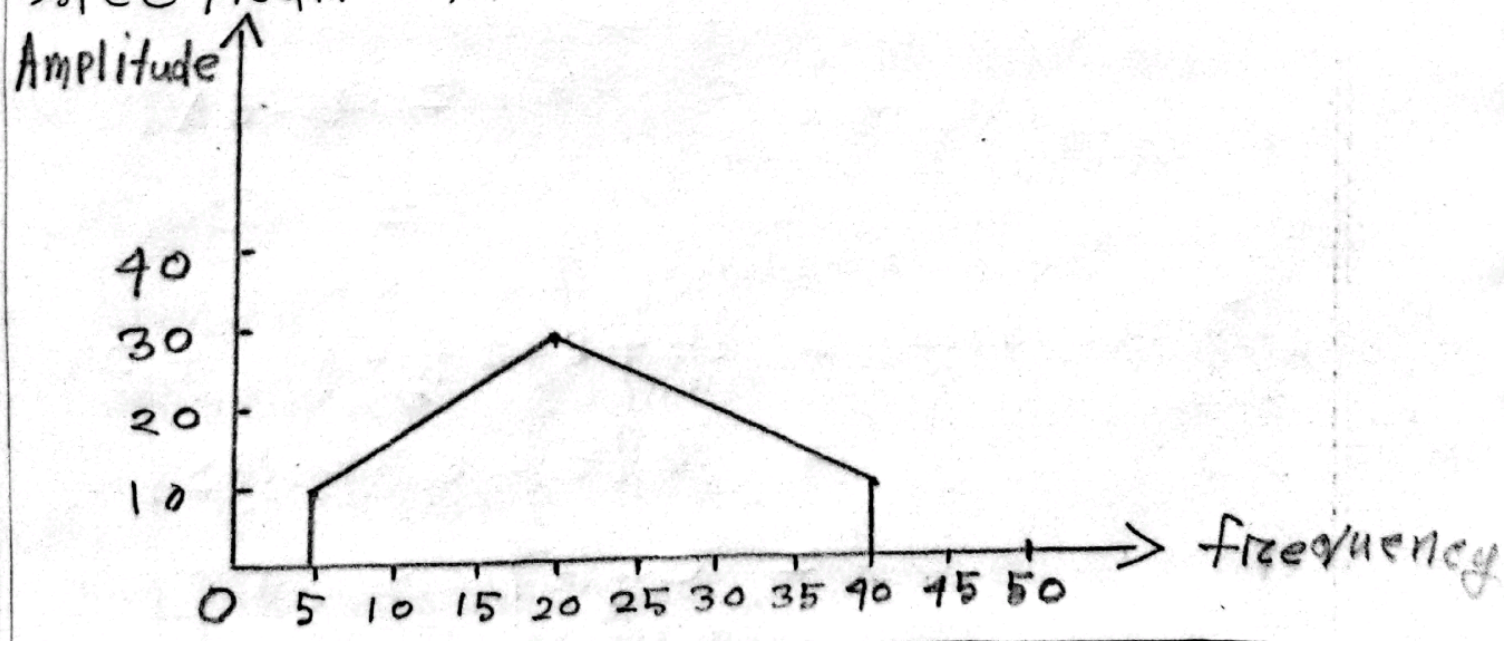
Ans. to the Q. No - 1

The lowest frequency = 5 KHz, amplitude 10V

The highest frequency = 40KHz, amplitude 10V

It is mentioned that for 20kHz, the amplitude is 30V.

So, According to the values we can say that, the amplitude increases from 10V to 30V as frequency increases from 5 KHz to 20KHz. Then it again decreases to 10V at 40KHz. The frequency spectrum is shown below:



Ans. to the Q. No 2

signal Power $P_x = 100\,W$

signal Power $P_y = 80\,W$

We know,

$$\text{Attenuation} = 10\log_{10}\frac{P_y}{P_x}$$

$$= 10\log_{10}\frac{80}{100}$$

$$= -0.9691\ dB$$

$$\approx -0.97\,dB$$

Here, attenuation is a negative value, so we can say this is sign of loss of Power of the signal

Ans. to the Q. No-3

Given,

$SNR = 2000$

Bandwidth $B = 12000$ KHz
$= 12000 \times 10^3$ Hz

$\therefore$ Maximum data rate $= B \times \log_2(1+SNR)$

$= 12000 \times 10^3 \times \log_2(1+2000)$

$= 131.59 \times 10^6$ bits per second

$= 132 \times 10^6$ bits per second (approx.)

Ans. to the Q. No-4

Frame size $= 6$ M bits
$= 6 \times 10^6$ bits

Number of routers $= 5$

Queuing time $= 5\,\mu s = 5 \times 10^{-3}$ ms

Processing time $= 2\,\mu s = 2 \times 10^{-3}$ ms

Link distance $= 3000$ km $= 3000 \times 10^3$ m

Propagation speed = 2×10^8 m/s

Bandwidth B = 10 Mbps

$= 10 \times 10^6$ bps

$\therefore$ Propagation delay $= \dfrac{\text{distance}}{\text{Propagation speed}}$

$= \dfrac{3000 \times 10^3}{2 \times 10^8}$

$= 15$ ms

$\therefore$ Transmission time $= \dfrac{\text{frame size}}{\text{Bandwidth}}$

$= \dfrac{6 \times 10^6}{10 \times 10^6}$

$= 0.6 \times 10^3$ ms

$= 600$ ms

$\therefore$ Total delay $= 15 + 600 + 5 \times 5 \times 10^{-3} + 5 \times 2 \times 10^{-3}$

$= 615.035$ ms

$= 0.615$ s (approx)

∴ Transmission time (delay) is dominant in total delay.

∴ Queuing delay and Processing delay are negligible.

Ans. to the Q. No - 5

Bandwidth = 20 Hz

Highest frequency = 60 Hz

We know,

∴ Bandwidth = High frequency - Lowest frequency

∴ Lowest frequency = 60 - 20 Hz

= 40 Hz

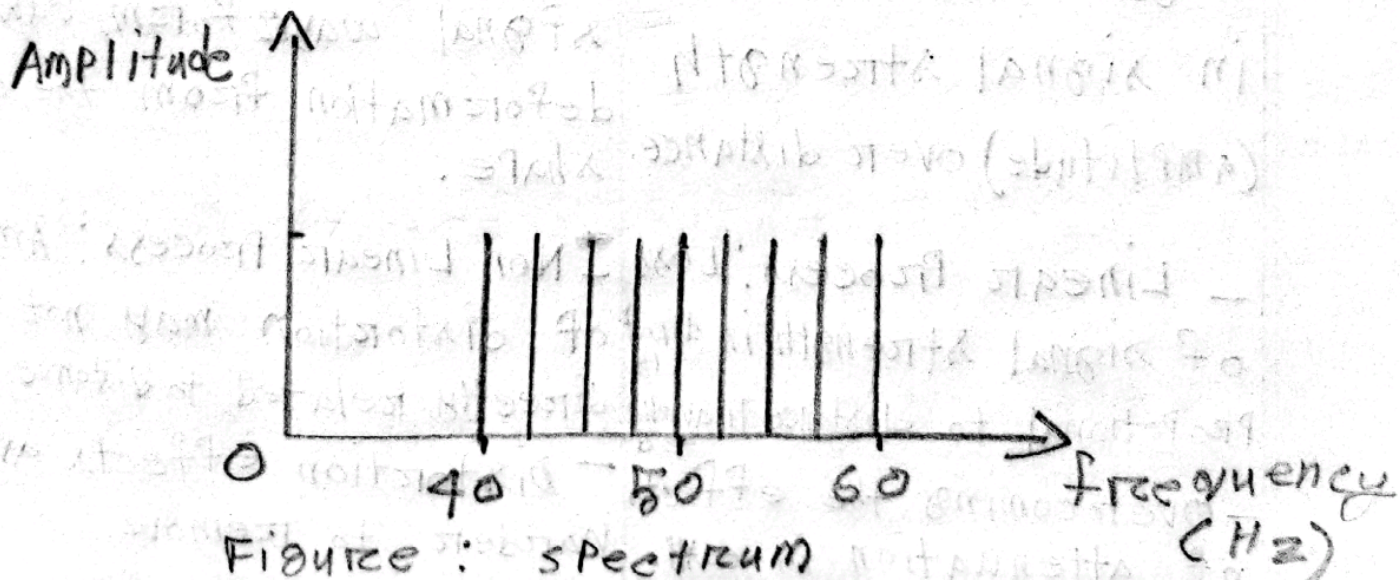


Figure : Spectrum

Ans. to the. Q.No-6

Data rate limits is an important consideration in data communication. Data rate limits are the maximum rates ~~where~~ at which data can be transmitted over a channel in bits per second. Data rate limits depends on three factors.

(I) Bandwidth Available: A wider bandwidth allows higher data rates as more information can be transmitted simultaneously.

(II) signal Level: Stronger signal enables faster and more reliable data transmission to higher data rates.

(III) Channel Quality: A noiseless channel supports higher data rates, while a noisy channel with interference reduces the rate of data transmission.

Ans. to the Q. No-7

Attenuation	Distortion
- Loss of energy of a signal	- Change of the form/shape of a signal.
- Gradual reduction in signal strength (amplitude) over distance.	- Alteration of the signal wave form, causing deformation from the original shape.
- Linear Process: Loss of signal strength is directly proportional to distance travelled	- Non Linear Process: Amount of distortion may not be directly related to distance travelled
- Overcoming the effects of attenuation is easy.	- Distortion effects are harder to remove.

Ans. to the Q. No - 8

Given,

signal Power = 200 milliwatts

$\therefore$ Total Noise = 10×2 microwatts

$= 10 \times 2 \times 10^{-3}$ milliwatts

$$\therefore SNR = \frac{\text{signal Power}}{\text{signal Noise}} = \frac{200}{10 \times 2 \times 10^{-3}}$$

$$= 10000$$

$$\therefore SNR_{DB} = 10 \log_{10}(10000)$$

$$= 40 \text{ dB}$$

Ans. to the Q. No - 9

$$SNR = \frac{\text{Avg. signal power}}{\text{Avg. Noise power}}$$

SNR is defined as signal-to-noise ratio. A higher SNR values indicates that the signal strength is greater than the noise strength which is more required in processing the signals. To achieve ~~this~~ a reliable connection, the signal level has to be significantly greater than the noise level. For instance, A wifi signal with a SNR of 40 will provide superior network services compared to the signal with SNR of 20. Hence, High SNR values are very much desirable in data communication.

Ans. to the Q. No - 10

(I) Bits per Level $= \log_2 L = \log_2(67)$

$= 6.06 \approx 7$

(In Integer)

(II) Bits per level $= \log_2 L = \log_2(128)$

$= 7$

(III) Bits per level $= \log_2 L = \log_2(198)$

$= 7.63 \approx 8$

(Integer)